LEGISLATIVE LIBRARY
WITHDRAWN
RECEIVED

SASKATCHEWAN RESEARCH COUNCIL

31ST ANNUAL REPORT 1977

THE RESEARCH COUNCIL ACT, 1965,
Clause 21, in part, directs that:

1. The Council shall on or before the last day of February in each year submit to the Lieutenant Governor in Council a report of its proceedings and transactions during the next preceding calendar year, which report shall contain such particulars as the Lieutenant Governor in Council may prescribe.

2. Every report shall forthwith be laid before the Legislative Assembly if then in session or, if it is not in session, within fifteen days after the opening of the next session.

Regina, February 22, 1978

●

TO THE HONOURABLE G. PORTEOUS

Lieutenant Governor of the
Province of Saskatchewan

MAY IT PLEASE YOUR HONOUR:

The undersigned presents herewith, for your consideration, the report of the Saskatchewan Research Council for the year ended December 31, 1977.

Respectfully submitted,

Norman Vickar, Chairman
Saskatchewan Research Council

PLEASE ADDRESS CORRESPONDENCE TO:

Saskatchewan Research Council
30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

CONTENTS

Table of Contents 1
Members of the Saskatchewan Research Council
Executive Officers of the Council's Staff 3
Proceedings of the Council 4

PROGRAM OF THE COUNCIL'S STAFF

Introduction 5
New Directions 7
Agriculture and Agricultural Processing 8
- Overview and Summary 9
- Farm Products — New Economic Uses 9
  - Straw — Feeding Value Improved by Ammonia 9
  - The Feeding Value of Crop Residues From Unusual Crops 10
  - Micro-Organism Treatment to Improve the Feeding Value of Low-Quality Forage 10
  - Straws as a Fibre for Paper and Clothing 10
  - Other Feed and Food Studies 10
  - Methods to Separate Alfalfa Into Improved Feed and Food Products 11
  - Evaluation of Faba Bean Plant as a New Source of Leaf Protein and Dehydrated Feeds 11
  - High Protein Content Seed Crops from Shelter Belt Trees 11
- Environment 11
  - Crop-Weater Relations 11
  - Control of the Drift of Pesticide Sprays 11
  - Health Hazards from Dusty Farm Operations ... 12
  - Pollution from Livestock 12
  - Measuring Pollution in Agricultural Areas 12
  - Organic Ammendments on Saline Soils 12
- Water 13
  - Surface Water 13
  - The Value of Sloughs and Potholes 13
  - Improving the Quality of Brackish Water by Spray Freezing 13
  - Improving the Water Supply from Wells 14
- Energy 14
  - Greenhouse Use of Waste Heat from Thermal Power Stations 14

Resource Development 15
- Mineral Resources 15
  - Geochemical Exploration Studies 15
  - Evaluation of Base Metal Potential 16
  - Quaternary Geology Program 17
  - Genesis of Saskatchewan Uranium Deposits .. 17
- Evaluation and Development of Known Resources 17
  - Lignite Coal Resources Evaluation 17
  - Clay Minerals 18
  - Recovery of Sodium and Magnesium Sulfate 18
  - Production of Magnesium Chemicals 18
- Renewable Resources 18
  - Conservation of Energy — Solar Home 18
  - Agricultural Energy Resources 19

Industrialization 20
- Industrial Engineering and Management Technology 20
- Technical Assistance 20
- Product Design 21
- Welding Technology 21
- Management Consulting 21
- Engineering Consulting 22
  - Industrial Minerals 22
  - Transport of Solid Materials Through Pipelines 22
- Chemical Process Research 23
- Fostering the Technical Upgrading of Saskatchewan Industry 23
- Publications for Upgrading Management and Technology 23
- Government Productivity 24

Environment 25
- Introduction 25
- Air 26
  - Weather Measurement and Modifications 26
  - Pollution Monitoring 26
- Water 27
  - Measurement of Precipitation 27
  - Location and Monitoring of Ground Water 27
  - Treatment and Monitoring of Water Pollution 27
- Land 28
- Engineering Activities 28
  - Investigation of Utilities and Structures 28
  - Test Facilities and Display Model 29
  - Impact Assessment Studies 29
  - Environmental Guidelines for Transportation Development 30
  - Environmental Impact Studies Group 30

Services 32
- Sample Analysis 32
- Graphics and Photography 33
- Workshops and Instrumentation 34
- Special Service Facilities 35

PUBLICATIONS 36

THE UNIVERSITY PROGRAM

- Scholarships 38
- Grants-In-Aid 39

Staff of the Saskatchewan Research Council 41

Financial Statement 43

List of Abbreviations 48

The SASKATCHEWAN RESEARCH COUNCIL is concerned with the development of the Province through the application of science for practical purposes.

MEMBERS OF THE SASKATCHEWAN RESEARCH COUNCIL

The Honourable Norman Vickar, Chairman
G. J. Gartner, Vice Chairman
D. Murray (Secretary)
G. Birney
E. B. Campbell
B. M. Craig
J. E. Fletcher
J. Hutch
L. Katz
A. Kavadas
R. E. Lloyd
K. J. McCallum
G. C. Mitchell
J. E. Spencer
E. B. Tinker

EXECUTIVE OFFICERS OF THE COUNCIL'S STAFF

Executive Director ..... T. P. Pepper
Administrative Officer ..... R. E. Melvin

Division Heads

Chemistry ..... E. M. Coxworth
Engineering ..... W. H. W. Husband
Geology ..... R. G. Arnold
Industrial Services ..... A. Scharf
Physics ..... J. Maybank

PROCEEDINGS OF THE COUNCIL

Membership of the Council remained at 15 during 1977. The Act allows a maximum membership of 21.

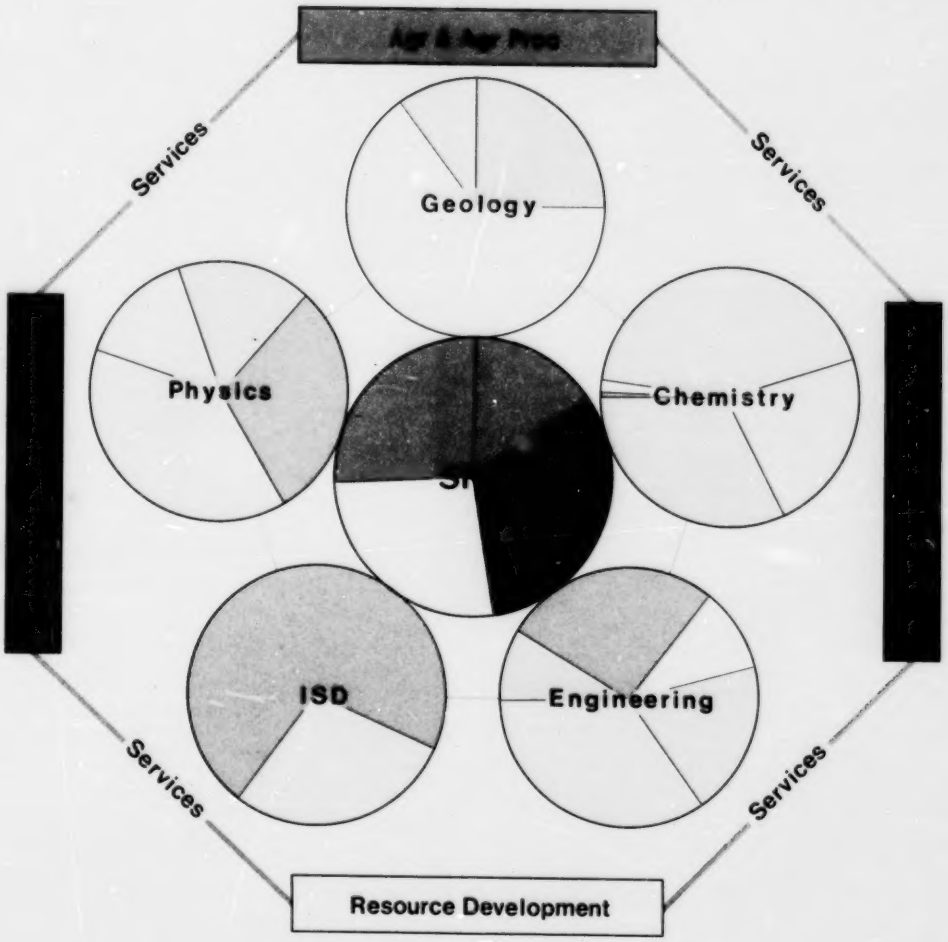
The Honourable Norman Vickar and Dr. Gerry Gartner continued as Chairman and Vice-Chairman respectively. Derek Murray became Secretary on the resignation of Dave Bock.

Other changes include the resignation of N. Bromberger and D. Pichler on the expiration of their terms of office. Council extends grateful thanks to these gentlemen for their contribution. Reappointed to a further three year term of office were J. E. Fletcher, A. Kavadas, and G. Mitchell. New members appointed to Council were J. Hutch and G. Birney.

To date, November 17, 1977, Council has met three times during the year: in Regina on February 3rd and June 27th and in Moose Jaw on October 28th. The main business of these meetings was to receive the reports of the Executive Committee and Executive Director, to formulate policy and priorities for the program of the laboratories, to approve the 1977-78 program and to provide policy guidance for the 1978-79 program.

The Executive Committee, consisting of the Chairman, Vice-Chairman, Secretary, and Dr. B. Craig, with the Executive Director acting as Secretary, has to date met five times since the last Annual Report: on December 6, 1976, April 4, May 30, August 26, and October 21, 1977. The main activities of the Executive Committee were to deal with routine administrative matters of the laboratories and, in conjunction with Council Management, to prepare policy and major administrative program items for discussion by the Council.

INTRODUCTION



The 1977 PROGRAM AREAS as illustrated within SRC's Divisions.

This year, the activities of the Saskatchewan Research Council (SRC) are reported by program areas rather than by separate divisions. Thus, various divisional activities now are included within sections organized under program headings. This reorganization reflects the policy change of Council to emphasize user needs.

Therefore, the year's activities are summarized under the headings:

- Agriculture and Agricultural Processing
- Resource Development
- Industrialization
- Environment
- Services

In order to understand the shift in emphasis to user needs, an accompanying diagram illustrates the relationship between the program areas and SRC's divisional structure.

Outside of the program areas, some important developments which occurred at SRC were:

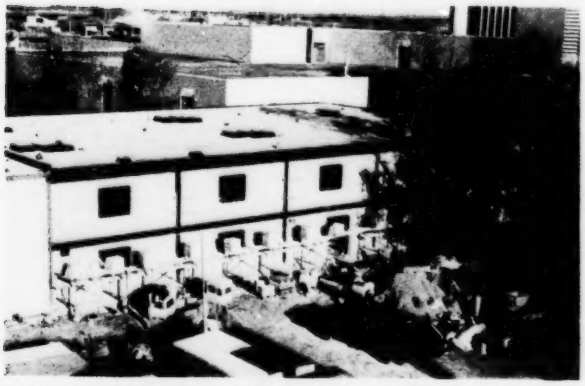
- The retirement of Mr. Ibhar Evans as head of the Division of Industrial Services.
- The amalgamation of Industrial and Management Services into a single Division of Industrial Services. Mr. Alan Scharf was appointed head of the new division.
- The establishment by SRC of Sareco Holdings Ltd., a holding company empowered to create and own satellite companies for specific technical undertakings. No satellite has been created as yet.
- The acquisition of 2,000 square feet of temporary space to meet emergency needs, especially for environmental impact assessment contracts.
- The commencement of an extension to the Storage Building to provide approximately 12,000 square feet to accommodate the expanded applied research and contractual programs of the laboratories.

In summary, SRC has continued to grow in providing service to Saskatchewan. The following reports give a comprehensive review of this year's work.

NEW DIRECTIONS

THE HONORABLE NORMAN VICKAR, Chairman of the Saskatchewan Research Council, examines a display of staff activities at the October 28th Council meeting in Moose Jaw.

EXECUTIVE DIRECTOR, Dr. T. P. PEPPER presented the SRC Award for a physical science project to Jim Bardwell at Saskatoon's first Health Sciences Fair.



CONSTRUCTION was begun on an EXTENSION to the Storage Building to accommodate program expansion at SRC.

THE SARCEE ANNEX has provided temporary space for emergency needs. Members of the Environmental Impact Studies Group utilize the greater portion of this space.

AGRICULTURE AND AGRICULTURAL PROCESSING

CLIMATOLOGY
MEASURING POLLUTION (ENVIRONMENT)
ORGANIC AMENDMENTS FOR SALINE SOILS
MINIMIZING DUST IN TRACTOR AND COMBINE CABS
ENVIRONMENT
DRIFT OF PESTICIDES
TREATMENT OF WASTE WATER BY BULRUSHES AND CATTAILS
LIVESTOCK POLLUTION
FIELD PEA FLOUR AND PROTEIN CONCENTRATE
FLAX FIBRE FOR PAPER AND LINEN
FUNGAL FERMENTATION OF ASPEN WOOD
FUNGAL FERMENTATION OF STRAW
HIGH PROTEIN IN SEED CROPS FROM SHELTERBELT TREES
FARM PRODUCTS
FABA BEAN PLANTS AS NEW SOURCES OF LEAF PROTEIN
ALFALFA FIBRE TO REDUCE CHOLESTEROL
FEED AND FOOD PRODUCTS FROM ALFALFA
TREATMENT OF STRAW AS CATTLE FEED
PREDICTING THE DIGESTIBILITY OF TREATED FEEDS
BIOMASS AS FUEL SOURCES
POTABLE WATER BY NATURAL REFRIGERATION
WATERSHEDS
WATER
ENERGY
SLOUGHS & POTHOLES
WATER WELLS
FARM ENERGY CONSERVATION PRACTICES
STACK-GAS HEAT TO HEAT GREENHOUSES

The AGRICULTURE AND AGRICULTURAL PROCESSING activities were centered around four topics.

OVERVIEW AND SUMMARY

Much of SRC's Research and Development Program is related to agriculture. This emphasis is not surprising since Saskatchewan's major activities are agriculture and agricultural processing. A total of 17 projects within the Council, plus 6 projects supported by university grants-in-aid, focus mainly on the agricultural sector of the economy. Many of these projects relate to industrial development through the processing of products such as flax fibre, cereal straws and forage crops.

The project relationships are summarized in the accompanying diagram in which the major research and development activities center around the following topics:

- Farm Products — new economic uses.
- Environment — environmental factors which affect or are created by agriculture and the minimizing of such problems.
- Water — improving local water supplies and reducing the effects of pollution.
- Energy — both conserving present energy use and searching for new energy sources.

Many of these projects involve cooperation with other groups and agencies within the Province, within the country, and in a few instances in other parts of the world.

FARM PRODUCTS — NEW ECONOMIC USES

The AMMONIATION OF STRAW may improve its feeding value for cattle. SRC is investigating this treatment in an effort to find low cost cattle feeds.

Straw — Feeding Value Improved by Ammonia

A recurring problem for the cattle industry in western Canada is the scarcity and high cost of feeds. SRC is investigating simple low-cost methods to improve the feeding value of straw and other low-quality forages. One method involves treating stacks of straw enclosed in gas-tight plastic bags with small amounts of commercial ammonia. This method is being tested on a practical farm scale in a joint project which includes SRC, Dr. Nicholson of the University of Saskatchewan (U of S's) Animal and Poultry Science Department and experimental stations of Agriculture Canada. The project is funded partially by the Saskatchewan Department of Agriculture (SDA) and Agriculture Canada.

NEEPAWA WHEAT straw was one of the most responsive varieties to ammoniation tests conducted by SRC staff.

SRC's studies of species indicate that the Prairies' most common wheat straw, Neepawa, was one of the most responsive to ammonia treatment. The maturation stage of the straw (close to or after the grain was mature) had surprisingly little effect. However, environmental factors such as moisture conditions and fertilizer levels, seem to be important influences on straw quality. These aspects are being investigated now.

Dr. Nicholson conducted growing trials with calves to compare ammoniated with untreated wheat straw. The results indicated that the treated straw's improvement in feeding value and nitrogen content more than offset the cost of the treatment, and rations containing the treated straw were significantly cheaper than untreated straw.

Ammoniation method demonstration trials were started on Saskatchewan farms as a cooperative program with SDA funded by the Federal Government's Drought Assistance Program. Before widespread use, solutions

must be found for problems such as high wind damage to the plastic covering of straw stacks, as well as scheduling ammonia treatment before winter temperatures halt the reaction.

Among other methods being investigated, ammonia released from urea by urease enzymes looks like a promising process, as does recovery of ammonia from aerobic fermentation of manure.

PUBLICATIONS

Coxworth, E., Kernan, J., Nicholson, H. and Chaplin, R. 1977. *Improving the Feeding Value of Straw for Ruminant Animals*. On Farm Waste Utilization for Feed-Opportunities and Profits for Livestock Producers, to be published by Agricultural Economics Research Council of Canada, Ottawa, Ontario.

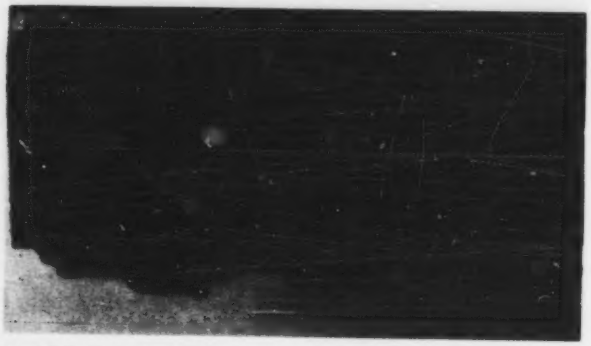
Kernan, J., Coxworth, E., Nicholson, H. and Chaplin, R. 1977. *Ammoniation of Straw to Improve Its Nutritional Value as a Feed for Ruminant Animals*. Extension Publication No. 239, College of Agriculture, U of S.

Sundstøl, F., Coxworth, E. and Mowat, D. N. 1977. *Improving the Nutritive Value of Straw and Other Low Quality Roughages by Treatment with Ammonia*. Accepted for publication in World Animal Review.

The Feeding Value of Crop Residues from Unusual Crops

Some new or unusual crop residues and forages are being evaluated for use as cattle feeds. Jerusalem artichoke tops, sorghum residue, wheat chaff, and slough hay responded well to ammonia treatment to improve feeding value. However, without ammonia treatment sunflower and sorghum residues were much higher in digestibility than the conventional cereal crops, which suggests an additional economic value of these new crops.

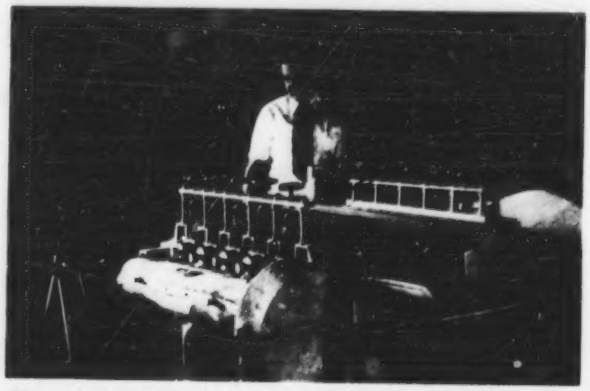
Micro-organism Treatment to Improve the Feeding Value of Low-quality Forages



WOOD ROT FUNGI are being tested as an agent to provide cattle feed from waste wood.

Certain micro-organisms degrade the lignin which locks up the otherwise nutritious cellulose in low-quality forages. This process is being investigated in a joint program with SRC, the microbiology group of the National Research Council's (NRC's) Prairie Regional Laboratory and the U of S. Various white-rot fungi produced only modest improvements. Tests are being conducted with other fungi, as well as the addition of ammonia or urea to aid digestibility.

Straws as a Fibre for Paper and Clothing



The processing of CANADIAN FLAX STRAW, using French equipment, was part of a project co-ordinated by SRC in Belgium.

SRC is project coordinator for an investigation utilizing western Canadian flax fibre. Last year, a field group went to France and Belgium to process the Canadian flax straw on French equipment. The group sought a textile grade tow and wanted a sufficient quantity of this grade for further testing. The results were negative. Now, western Canadian flax fibre is being examined as a pulp source for paper. A Saskatchewan pulping company is investigating the feasibility of establishing a flax pulping operation in Prince Albert.

As an off-shoot of this study, a new project is being developed to investigate the potential of growing linen-type flax fibre in western Canada. This cooperative project is being done by the Western Canadian Flax Growers Association and the U of S's Crop Development Centre.

If successful, the flax project would result in a by-product being processed and exported. Benefits would accrue to the farmer, Saskatchewan industry, and the country because a large portion of the by-product would be sold overseas.

Other Feed and Food Studies

SRC extends its research capacity with grants-in-aid for University studies involving other feed and food sources. Professor Sumner of the U of S received an SRC grant-in-aid to investigate the functional properties of pea protein flour products in developing new markets in the food industry. Dr. Federoff of the U of S's Anatomy Department is testing alfalfa fibre as a food additive to reduce cholesterol levels in the blood. Dr. MacDonald of

the U of S's Chemistry and Chemical Engineering Department, is studying the various methods of using micro-organisms to produce protein and sugar from modified

ASPEN TREES may provide protein and sugar after modification with micro-organisms.

aspen wood, which is one of Saskatchewan's major tree resources. Drs. Chaplin, Jones, Mathews, and Pepper, of various departments in the U of S, received a grant-in-aid for the continuing study of the digestibility analytical procedures involved in feeding livestock unconventional roughages.

Methods to Separate Alfalfa into Improved Feed and Food Products

Although a major feed source of cattle and sheep, alfalfa has never been a significant feed item for pigs and poultry, or for people. A major new market could be developed for alfalfa if methods can be found to improve digestibility and feeding value of the leaf fraction for simple stomach animals. The U of S's Animal and Poultry Science Department completed a trial with growing rats to test the digestibility and feeding value of this alfalfa fraction. The addition of cholesterol was found to suppress the effect of potentially toxic saponins in the alfalfa leaf and to improve the intake of the alfalfa fraction but did not improve digestibility. The evidence suggests that methods which reduce saponins but do not require addition of cholesterol might improve feeding value. These studies have been supported by a grant from the SDA.

Evaluation of the Faba Bean Plant as a New Source of Leaf Protein and Dehydrated Feeds

In collaboration with the U of S's Crop Science Department, SRC is examining different methods of processing whole faba plants as a new material to provide leaf protein and crops for the dehydration industry. Four different varieties of faba beans have been processed at different stages of plant growth, and the various materials now are being analyzed. The leaf protein obtained from faba bean plants is being compared with similar materials prepared from alfalfa.

High Protein Content Seed Crops from Shelter Belt Trees

Carragana and Manchurian Elm are common drought resistant trees planted in hedgerows and shelterbelts throughout the Prairie region. The seed of both species was found to be quite high in protein. Further studies are in progress to determine the amino acid composition of these two seed sources as potential feeds.

ENVIRONMENT

Crop-weather relations play a vital role in determining how Saskatchewan's agricultural production will fare. This autumn, SRC took part in a workshop which studied various crop-weather models presently in existence and tested these models for their yield prediction reliability. This summer, a cooperative program with Agriculture Canada and SDA was continued to predict grasshopper populations and outbreak dates from past weather, as well as to relate these data to the various growth stages of the season's wheat crop. Development of these predictions should provide data for more timely spraying of insecticides.

An investigation of extreme weather events, with emphasis on maximum probable rain storms is in the first report stage. SRC is active on both the Canada and Saskatchewan committees on Agrometeorology and has lent support to the preparation of the Guide to Farm Practice section on this subject.

Control of the Drift of Pesticide Sprays

If the drift could be reduced, then less pesticide would be needed, thus reducing the cost of treatment, less harm would occur to locations where a chemical is not wanted, and the safety of the machine operator would be improved.

A PLATE is examined for PESTICIDE DEPOSIT applied during an aerial spray test.

Aerial spray tests were conducted under a research contract with Agriculture Canada. The results were used by Provincial regulatory agencies and others for recommendations towards better application techniques to control spray drift.

One aerial spray test was conducted with the cooperation of PFRA's pasture development division. Analysis indicated that up to 50% spray drift off target was related to topography and spray distribution pattern. In another test this summer, SRC monitored the skin exposure of operators during bush spraying which has concerned provincial occupational hygienists. The monitoring indicated a wide ratio of skin exposures for varying duties in decreasing order of roughly 100:10:1:0.1. These results indicate a need for further monitoring with other pesticides.

SRC STAFF MONITORED the spraying operations of several farmers in order to relate test data with actual conditions.

In order to relate such test data with actual conditions, SRC monitored the spray operations of several farmers. The results indicate discrepancies in uniformity, drift control and losses of spray effectiveness, even in careful farm application.

An AIR CUSHION SUPPORT system was tested for pesticide application to determine spray drift control and swath deposit.

One promising approach to improved pesticide application is the use of an air cushion support system. A prototype, tested in October, demonstrated good drift control even at high wind speeds but poor swath deposit uniformity. Practical modifications are underway which could solve the uniformity problem. If further tests next year indicate satisfactory performance, the device might be manufactured in Saskatchewan.

Health Hazards from Dusty Farm Operations

Farmer's Lung is the major health hazard caused by working in a dusty farm environment. However, little is known about the dust levels of major farm operations in the Prairie provinces. A dust sampling project has been conducted since the spring of 1977, jointly with the U of S's Department of Agricultural Engineering. Resulting recommendations for methods of clean-air farm operations will be made for seeding, pesticide spray application and combine harvesting.

Pollution from Livestock

The Family Farm Improvement Branch of the SDA awarded SRC a contract to carry out field studies on the generation and transport of pollutants from feedlots and manure spreading areas in the Qu'Appelle basin. The study, started in 1976, will terminate in 1978. Data on the production and transport of nutrients during snowmelt runoff have been collected, analyzed and interpreted to provide information for pollution guidelines. About 75% of the work has been completed.

Measuring Pollution in Agricultural Areas

Professor Lackie of the U of S's Civil Engineering Department received a grant-in-aid to study measuring pollution from large feedlots using aerial photography methods to correlate with on-ground procedures.

Organic Amendments on Saline Soils

Soils affected by salinity are a serious problem in Saskatchewan. Last year, a project was initiated measuring the effect of various organic amendments to improve crop production on saline soils. The tests indicated that cattle manure gave the best results.

This year, the testing included various organic treatments with and without N-P fertilizer. Uniformity was observed except that the N-P fertilized portions matured slightly earlier.

The previous 1976 plot was retested using this year's method and various organic soil amendments. In all cases, crop production was not sufficient to justify the expense of such high fertilization rates.

To obtain an estimate of soil salinity a crop-height index was employed using LIFT photography together with 1976 on-ground measurements. Biomass yield, grain yield and protein content, were inversely correlated with soil salinity.

PUBLICATIONS

Coxworth, E., and Thompson, D., *Searching for Appropriate Technologies to Resolve the Conflicts between Development and the Environment of the Canadian Plains*. To be published in the Proceedings of the Canadian Nature Federation Conference on Nature and Change on the Canadian Plains held in Regina, Sask., August, 1977.

Grover, R., Kerr, L., Wallace, K., Yoshida, K., and Maybank, J., *Residues of 2,4-D in Air Samples from Saskatchewan: 1966-1975*. Jr. Environ. Sci. Health, B 11(4): 331-346. 1976.

Maybank, J., Yoshida, K., and Grover, R., *The Magnitude and Importance of Spray Drift from Agricultural Applications*. Air Pol. Control Assn. Paper 77-45.2, June, 1977.

Maybank, J., Yoshida, K., Shewchuk, S. R., and Grover, R., *Spray Drift and Swath Deposit Pattern from Agricultural Pesticide Application: Report of the 1976 Field Trial Program*. SRC Report P 77-1.

Wallace, K., and Yoshida, K., *Size Analysis of Suspended Dusts By Sierra Cascade Impactor and Computer Graphic Techniques*. SRC Report P 77-6.

Yoshida, K., and Maybank, J., *Physical and Environmental Characteristics of Grain Dust*. International symposium on Grain Dust and Health. Workshop: Environment, 1977.

Yoshida, K., Shewchuk, S. R., and Maybank, J., *Design of Sampling and Analytical Techniques for Respirable Grain Dust for Correlation with a Clinical Study of Pulmonary Disease Characteristics Among Grain Handlers*. SRC Report P 77-2.

Yoshida, K., Shewchuk, S. R., and Maybank, J., *On the Nature of Environmental Grain Dust Pollution on the Canadian Prairie*. Air Pol. Control Assn. Paper 77-3.6, 1977.

Yoshida, K., Shewchuk, S. R., and Maybank, J., *Dynamic Shape Factor Determinations of Grain Dust*. Paper presented at 10th Aerial Technology Conf. Los Alamos Scientific Lab. N.M. 1977.

WATER

Surface Water

The recent near-drought in the Province emphasized the need to predict availability of surface water resources and long term hydrological effects of wetland drainage. Stream flow data from 43 large watersheds and six small SRC drainage basins have been analyzed to develop a tentative watershed model. The simple watershed model is being developed to predict the behaviour of small watersheds under various conditions of controlled snowmelt. Information obtained from this model will be used for:

- Predicting the long term effects of drainage and flooding.
- Evaluating the influences of snowcover and snowmelt on land use.
- Evaluating man-made practices on snowcover and snowmelt, farm dugouts and the quality of water runoff.

The Value of Sloughs and Potholes

Much of the surface run-off flows into Prairie sloughs and potholes which serve as sources of groundwater recharge and fresh water supply, as well as habitats for wildlife. These wetlands are the most important waterfowl breeding area in North America. However to the farmer, these wetlands are often nuisances which hinder agricultural operations and increase production costs. Therefore, he drains sloughs and potholes for a more effective farm operation.

SLOUGHS AND POTHOLES serve as important waterfowl breeding areas but hinder agricultural operations. SRC staff is developing a systematic approach to resolve this conflict between the farmer's needs and waterfowl nesting areas.

For 12 years, hydrometeorological data have been analyzed from about 120 sloughs in an attempt to resolve the conflict of interests over wetlands useage in the Province. In addition, information has been obtained on the socio-economic aspect of the wetland alternatives. A systems approach is being developed to determine which wetlands should be maintained for various uses, and which wetlands may be drained and the land reclaimed for agricultural use.

Improving the Quality of Brackish Water by Spray Freezing

SPRAY FREEZING brackish water utilizes Saskatchewan's natural freezing to provide potable water for human and livestock consumption.

The quality of the water available for human or livestock use is another agricultural problem. The only reliable, well-distributed water source in southern

Saskatchewan is brackish groundwater. The salt content must be reduced to provide good quality water. This salt reduction can be done by spray freezing using the natural refrigeration of the Prairie winter. Spray freezing trials are undertaken each winter at Saskatoon, Armley, Blucher, Bruno and Frontier using the major types of brackish groundwater occurring in Saskatchewan and covering a range of climatic conditions. During 1976-77, these trials showed a more than 50% reduction in salt content with a more than half recovery of input water. No problems were encountered.

This project is funded under the joint federal-provincial ARDA program.

Improving the Water Supply from Wells

SRC is engaged in applied studies to contribute to the technology of water well development.

Again, several farmers requested the use of the Council's clamshell dredge which was designed several years ago to remove silt, fine sediments or other material which entered and settled in the bottom of water wells. The dredge aids in safely and economically servicing certain types of large diameter water wells to improve storage capacity and to permit faster entry of water to the well.

Another project concerning groundwater involves the analysis of temperature measurements in the ground. The temperature gradient increased with depth and was related partly to the downward groundwater flow. Detecting the vertical groundwater movement is a difficult problem. A study appears to show that temperature measurements afford a means of detecting vertical groundwater movement.

ENERGY

Greenhouse Use of Waste Heat from Thermal Power Stations

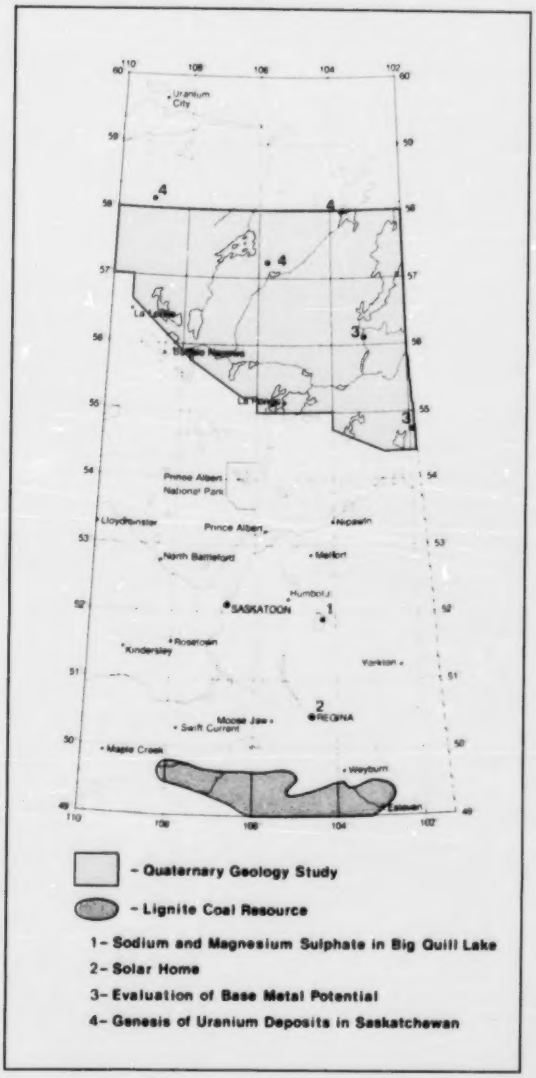
Fresh fruit and vegetables are a major part of Canada's food import bills. The feasibility of growing more of these crops in Canadian greenhouses has been hindered due to high cost of heating. Drs. Maginnes and Green of the U of S received an SRC grant-in-aid to study heating a greenhouse from stack gases in a coal-fired power plant. Simple technqiues are being developed using stack gas heat to produce vegetables by growers with minimum experience in order to encourage more production.

Using pipe heat exchangers, stack gases could provide all the heat needed until the outside temperature reached -20 C. A disadvantage was that flyash in the stack gases coated fans and pipes.

Preliminary calculations indicate that the costs of installing the waste heat system for one acre of greenhouses would be an extra $74,000. At existing rates for natural gac and electricity, the pay-out period for the waste heating system would be four to five years. Two acres of greenhouses are probably the upper limit for using hot exhaust gases directly from the base of one stack, due to distance and space limitations. However, gas-to-liquid heat exchangers would enable heating a larger complex, thus allowing the greenhouse to be located a greater distance from the stack. Studies now are underway examining the economic feasibility of using gas-to-water heat exchangers and hot water as the transport and the heating medium for a proposed greenhouse.

AGRICULTURE

RESOURCE DEVELOPMENT



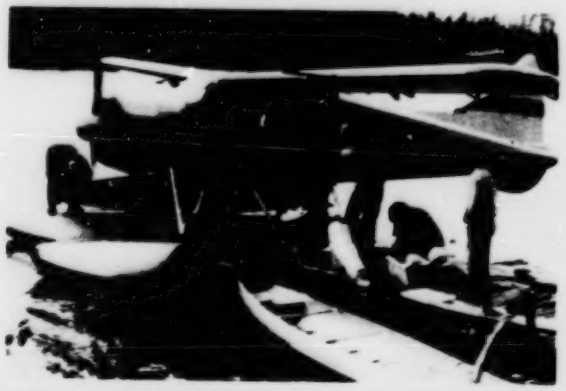
Resource development provides important socio-economic benefits for Saskatchewan. Such development was directed both towards the discovery of new mineral resources and to the evaluation, development and utilization of known resources.

MINERAL RESOURCES

The development of metallic mineral deposits follows a number of stages from reconnaissance surveys and property acquisition, through detailed ground surveys, drilling, feasibility studies, and mining. The reconnaissance stage of exploration can involve geological and geochemical surveys which SRC is undertaking to increase the effectiveness of Provincial exploration.

Geochemical Exploration Studies

Geochemical exploration uses the concentration and distribution of metals in surficial materials, such as bedrock and overburden, as guides to the location of underlying ore deposits of these metals in the Precambrian terrain. Exploration requires an extensive understanding of how ore metals are distributed in a geological area.



A MULTI-DISCIPLINARY TEAM of geologists requires a variety of technical equipment to investigate all aspects of the geologic environment in a granite-pegmatite area north of Pelican Narrows.

During 1977, SRC geologists went to a granite-pegmatite area north of Pelican Narrows to study how uranium and other metals derived from bedrock move and concentrate in lakes, swamps and overburden. A multi-disciplinary team of geologists provided the broad expertise necessary to investigate all aspects of the geologic environment. The activities of these experts included bedrock mapping and geochemical sampling of rocks, lake sediments and waters, as well as mapping and collection of glacial overburden. This program will provide an understanding of the geological environment for exploration of metals in the Pelican Narrows area. The Saskatchewan Department of Mineral Resources (DMR) shared in funding this project.

PUBLICATIONS

Arnold, R. G., Smith, J. W. J., *Summary of Mercury Concentrations in Rocks, Overburden, Muskeg and Lake Sediments Collected by SRC in Precambrian Areas of Saskatchewan*. Geol. Div. Circular 11, 1977.

Lehto, D. A. W., Arnold, R. G., Smith, J. W. J., *Lake Sediments as Media for Exploration in Saskatchewan*. Sask. Geol. Soc., Special Pub. No. 3. Editor, C. E. Dunn, 1976.

Lehto, D. A. W., Smith, J. W. J., Arnold, R. G., *Multimedia Geochemical Evaluation of Anomalous Metal Concentrations in Lake Sediments — Summary Report, 1977*. Published in Three Volumes. DMR OPEN FILE 1978.

Sopuck, V. J., Lehto, D. A. W., Alley, D. W., *Uranium Dispersion Studies in the Maguire Lake Area, Saskatchewan*. In Summary of Field Investigations, 1977. DMR, Regina, Sask.

CONTRACT

Uranium Dispersion Studies in the Maguire Lake Area, Saskatchewan. Partially funded by DMR.

Evaluation of Base Metal Potential

LIVING QUARTERS were set-up in the Brabant Lake area for a Geology Field crew to study controls for zinc deposition.

Base metals such as copper, lead and zinc occur in rocks of volcanic affinity such as the copper-zinc ores at Flin Flon. Saskatchewan has considerable areas of known and suspected old volcanic terrain. SRC is studying criteria to assist in recognizing these old volcanic rocks and to select those areas which have good potential for mineral deposits. SRC's work in the Amisk Lake area has led to staking and re-examination of areas by several mining companies. This year, SRC studied controls for zinc deposition in the Brabant Lake area which has a known sub-economic zinc deposit. When the controls responsible for zinc deposition in bedrock are understood, additional areas favourable for exploration can be outlined. In 1977, two contracts were undertaken to determine the mineral potential of Precambrian terrain for an exploration company.

PUBLICATIONS

Fox, J. S., *Rapid Pyroclastic Mapping in Base Metal Exploration*. Can. Inst. Mining Jour., March, 1977.

An SRC Scientist investigates iron- and magnesium-rich intrusive rocks with abestiform alteration for hosting in nickel and asbestos deposits.

Fox, J. S., *Preliminary Litho-Geochemistry Maps of the West Amisk Area: Lead, Zinc and Copper in Area 63L-9W-1/2-16 SW Portion*. SRC 1977.

Fox, J. S., *Geology of Saskatchewan Mining Development Corporation Grids in May Lake Area, Sask. 1977 (Confidential)*.

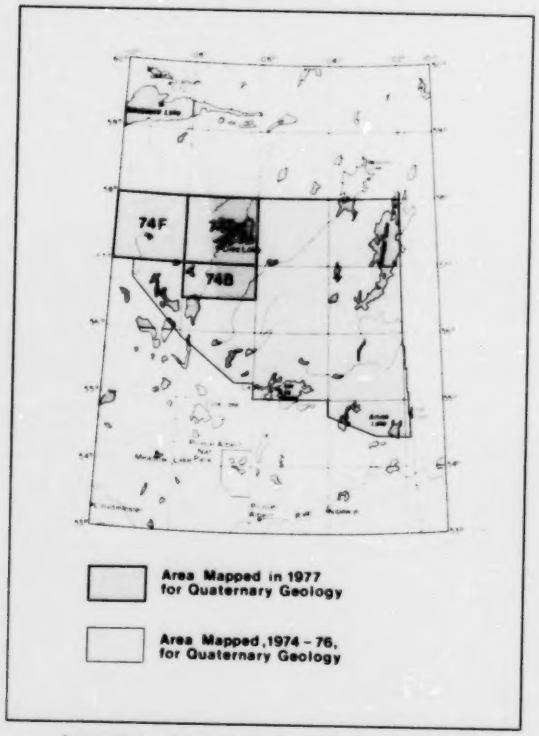
Fox, J. S., *Reconnaissance Geology of Saskatchewan Mining Development Corporation Claim Blocks CBS 3102 and 3103, Missi Island Area, Saskatchewan. 1977 (Confidential)*.

Fox, J. S., *Silica Normalization of Drill-Hole Geochemical Data from the Volcanic Rocks of the Hanson Lake Mine, Saskatchewan*. Geol. Div. Circular 10, 1977.

The QUATERNARY GEOLOGY PROGRAM involves an investigation of the glacial overburden that overlies bedrock.

Quaternary Geology Program

A major problem in northern exploration for mineral deposits is the extensive cover of glacial overburden that obscures bedrock. However, an understanding of the stratigraphy, physical and chemical properties, and the genesis of glacial overburden are important in the exploration for minerals. Overburden is basically bedrock ground up by glacial processes and consequently contains clues to the presence of metallic ores that occur in the parent bedrock. Several important uranium discoveries have been made in Saskatchewan by tracing uranium in overburden back to its source in bedrock.



Location of quaternary geology mapping.

This year, SRC mapped glacial deposits in the Cree Lake (74G), Lloyd Lake (74F) and Mudjatik areas (74B) which completes a four year program. Mapping has been completed from the southern edge of the Precambrian to 58° north latitude. This study was funded by DMR under a Federal-Provincial Mineral Development Agreement.

PUBLICATION

Schreiner, B. T., *Quaternary Geology North: Cree Lake (74G), Lloyd Lake (74F) and Mudjatik Area (74B, N-1/2), Saskatchewan.* In Summary of Field Investigations, 1977. DMR, Regina, Sask.

Genesis of Saskatchewan Uranium Deposits

For several years, SRC has had a continuing program to study how uranium deposits are formed in Saskatchewan so that geological and geochemical guidelines can be developed to aid further exploration. Studies of the Gulf Minerals deposit indicate a complex history of deposition and alteration of uranium and other minerals near the crystalline Precambrian bedrock surface.

PUBLICATION

Hoeve, J., *Uranium Metallogenic Studies II. Rabbit Lake, Mineralogy and Geochemistry.* In Summary of Investigations, 1977. DMR, Regina, Sask.

EVALUATION AND DEVELOPMENT OF KNOWN RESOURCES

The projects undertaken in this broad category involve the evaluation of known resources by field and laboratory studies and in some cases, an evaluation of methods of extracting and utilizing resources.

Lignite Coal Resource Evaluation

Saskatchewan lignite coal resources will become more important in supplying the Province with future energy requirements as natural gas and oil reserves become depleted. In 1972, Federal and Provincial Governments initiated an extensive evaluation of Saskatchewan coal resources. DMR, the Geological Survey of Canada and

A COMPUTER SYSTEM was developed by SRC to store, retrieve and process information for the coal evaluation program.

SRC undertook portions of the study. Preparation is nearing completion of a report and atlas of maps summarizing SRC's field and laboratory studies. The Council will supervise printing of the final report in 1978.

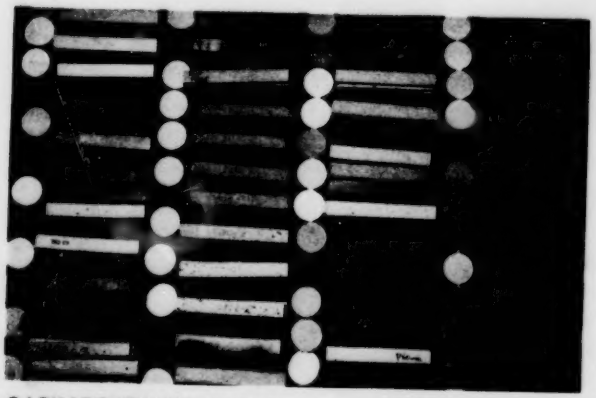
An important aspect of the coal evaluation program has been the development of a computer system to store, retrieve and process the information. Three computer processable files have been developed to store data on coal quality, borehole geophysical logs and the occurrence of coal seams. A major activity was to compile depth alignment information for each drill site so that information in each of these files is aligned to a common elevation datum. This alignment is a prerequisite to cross-correlation when calculating the quality of coal in specified coal seams. Such cross-correlation of geophysical and geological measurements will enable estimates to be made of the quality of coal in seams which were not sampled and for which chemical quality data are not available. SRC will publish a series of volumes on the quality and occurrence of coal for specific areas in southern Saskatchewan.

The coal evaluation studies are funded by the Canada Department of Energy, Mines and Resources (EMR) and DMR.

PUBLICATION

Pilon, C. A., *Bibliography and Index of Coal in Saskatchewan and Adjoining Provinces and States*. Geol. Div. Report 18, 1977.

Clay Minerals



SASKATCHEWAN CLAYS were investigated for their potential in commercial utilization.

In addition to lignite coal, other minerals are being evaluated for their potential for commercial utilization. For example, Saskatchewan clays were investigated as a possible raw material for ladle brick which is a type of steel plant refractory. Two types of clay were identified for commercial use and brought to the attention of refractory brick manufacturers.

Recovery of Sodium and Magnesium Sulphate

A ten year study was completed this year of the sodium and magnesium sulphates in Big Quill Lake. The objective was to determine the water and salt balance of the lake in order to develop methods of recovering the salts. Results show the salts, leached from overburden by water, enter the lake through the soil and the strata beneath the lake. During the past 10,000 years, nearly 20 million tons of salts have accumulated in the lake. The salt content of the lake water fluctuates between 3 and 8 percent.

Salts can be recovered from Quill Lake if the brines are concentrated to about 15 percent by solar evaporation or freezing. A project to investigate recovery of salts by spray freezing in winter was funded jointly by Saskatchewan Minerals and EMR.

Production of Magnesium Chemicals

An economic feasibility study was made of manufacturing magnesium salts. Four different conversion processes were evaluated and optimum methods are being considered for supplying process energy.

RENEWABLE RESOURCES

Conservation of Energy — Solar Home

An ENERGY-CONSERVING SOLAR HOME was built in Regina by a team of specialists headed by SRC staff.

A team of specialists, which was headed by SRC staff, designed an energy-conserving solar home built in Regina. This home was designed to demonstrate efficient methods for heating and energy conservation. The home is heated by both a conventional electrical system and a solar system. The main energy savings are achieved by the use of super insulation and infiltration control. The project is funded jointly by the Saskatchewan Housing Corporation and DMR.

PUBLICATIONS

Eyre, D., Jennings, D., Thompson, D., Besant, R., Dumont, R., Grolle, H., *A collection of technical notes relating to the design of the Saskatchewan energy-conserving demonstration house*.

Eyre, D., *Energy Conservation in Farm Homes*. Seminar on Energy Conservation in Agriculture. Regina & Saskatoon. April 15-16, 1977.

Eyre, D., *The Saskatchewan Conservation House — Its Impact on the Building Trades*. Annual conference of Saskatchewan Branches of HUDAC. Waskesiu. September 17, 1977.

Eyre, D., *The Design Concepts of the Saskatchewan Conservation House*. Meeting of the Saskatoon Branch. Solar Energy Society of Canada Inc., June 21, 1977.

Eyre, D., *Insulation — the Logical Way to Conserve Energy*. University of Regina. Department of Extension. Solar Heating Course. Fall 1977 Semester.

Agricultural Energy Resources

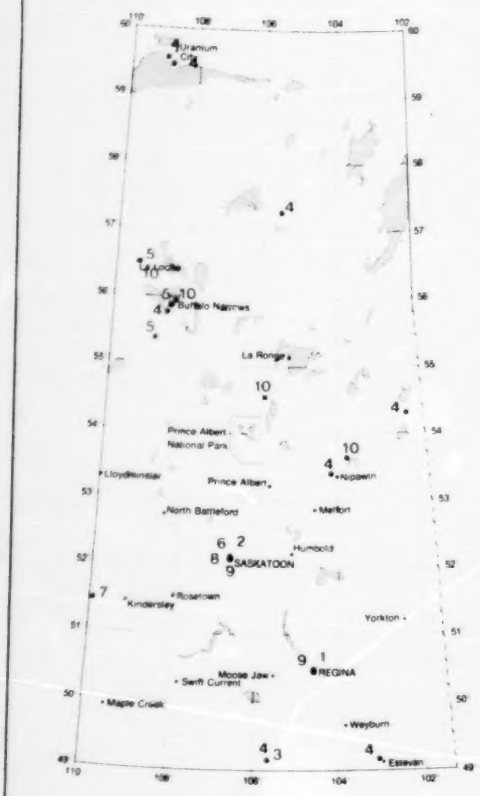
The rising costs of fossil fuels impose financial difficulties on farmers. Two studies undertaken by SRC attempt to find local, renewable energy sources and practical ways in which they can be used by farmers.

The first study is an evaluation of biomass resource in the Province and how much might be used. One evaluation deals with the use of straw to run all the farm machinery with the same efficiency as present fossil fuels. The question arises: What amount of straw can be used safely for energy purposes without adverse effects on the soil? For some farms, the removal of straw for conversion into energy would still leave enough organic matter for returning to the soil and protection from wind erosion. For farms in the more arid regions, using straw for energy purposes would not leave enough straw for economical farm use. Therefore, these farmers would have to consider other methods of supplying biomass or alternate fuels for energy.

A second study recorded the energy consumption in farm handling and utilization of forage, straw and manure. Eight pairs of farms were selected. Within each pair, one farm operator used energy conservation practices and the other farm operator did not. The first year of the study is to be completed by the end of February, 1978. This project is in co-operation with the U of S, the SDA and Supply and Services Canada which is financing one summer student.

RESOURCE DEVELOPMENT

INDUSTRIALIZATION



1 – Highway Test Track
2 – Education Building Air Intake Study
3 – Poplar River Reservoir - Scaling Study
4 – Environment Impact Studies Group
5 – Sulphur Measurement
6 – Elevator Grain Dust Monitoring
7 – Weather Measurement and Modification
8 – Precipitation Studies
9 – Water Pollution Study
10 – Utilities and Structures

Saskatchewan has the least number of industrial workers per capita in Canada. Therefore, industrialization is an important SRC activity which can create jobs, increase our standard of living, replace expensive imports and provide a stabilizing force to our variable agricultural economy.

SRC's role in industrialization is concerned primarily with the utilization of Provincial resources through the application of the most appropriate management and engineering technologies. A free advisory service to Saskatchewan manufacturing industries has been provided to further SRC's role in industrialization. For almost a quarter of a century, SRC has provided this service through the support of the National Research Council of Canada (NRC).

INDUSTRIAL ENGINEERING AND MANAGEMENT TECHNOLOGY

SRC's Industrial Engineering Program provides assistance to small and medium sized manufacturers in plant layout, cost accounting, methods and productivity improvement, product pricing, and production planning and control. This assistance; enabled a food processer to triple sales volume and profits; enabled a manufacturer, through the application of methods improvement techniques, to effect a $20,000 annual savings; and enabled an automotive remanufacturer through better piecework installation to increase productivity and profits. In addition, SRC's assistance in establishing incentive plans has increased the profits of several companies.

TECHNICAL ASSISTANCE

SRC operates the NRC-supported Technical Information Service which provides manufacturers with help

RUST CORROSION tests were analyzed for a client by a member of the Technical Information Service in consultation with NRC.

in areas such as technical process problems, painting, corrosion and environmental problems. In 1977, this program handled about 700 inquiries and provided the design of a machine for a tree grower which increased the seeding rate ten-fold, the reduction of scrap in a sheltered workshop through new product development and the solution of a difficult machining problem for a small machine shop.

The Technical Information Service also makes available to manufacturers, up-to-date technical literature through CISTI (Canadian Institute of Scientific and Technical Information) by means of a computerized information retrieval program.

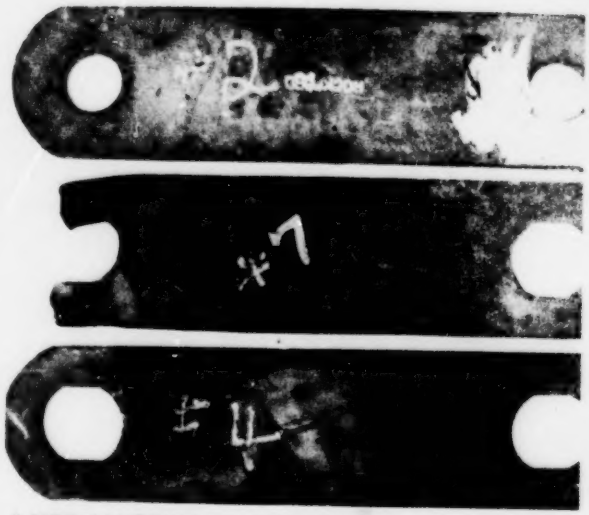
PRODUCT DESIGN

The DESIGN FOR PRODUCTIVITY PROGRAM is the only computerized design and evaluation service in western Canada.

A new program, Design For Productivity, uses the most advanced computer techniques to assist manufacturers in both product evaluation and design. This program is the only computerized design and evaluation service in western Canada. The service has made significant improvements in products such as seed drills, steel buildings, potash processing machinery, cranes and trailers. Most of these improvements were effected without the necessity of field testing. New products also were developed such as a logging trailer which is now in commercial production. This program enabled the marketing of Saskatchewan-made products worth over $300,000. New jobs have been created and significant raw material savings have been made by manufacturers.

WELDING TECHNOLOGY

Closely allied to the Design for Productivity program is SRC's metallurgical assistance service which is supported by the Canadian Welding Institute and NRC. This three-fold service encompasses advice on improving welding processes in manufacturing, failure analysis, and training of welding supervisors and managers. Over 70 technical inquiries were handled this year plus ten major failure analyses. In one project, the welding repair of a large autoclave saved over $200,000 for the concrete industry by avoiding production delays. In another project, SRC's analysis of the failure of a large raw ore drag chain and recommendations for correction generated a saving of $42,000 for one client.



A METALLURGICAL INVESTIGATION of a raw, ore-drag chain failure revealed:

- *Where further failures would occur*
- *Whether or not the steel used had the correct composition, heat treatment and mechanical properties*
- *How repairs could be effected.*

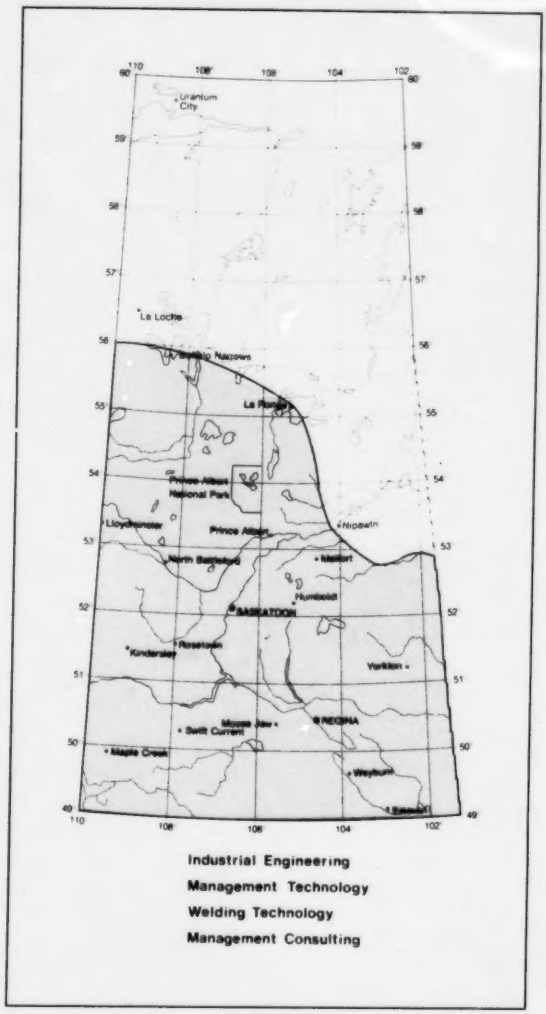
MANAGEMENT CONSULTING

This service emphasizes the management technology of the industrial engineering approach. Clients include governments, associations, manufacturing industries and businessess. Types of management consulting included:

- a significant productivity improvement program in a large Saskatchewan crown corporation;
- a study of the Saskatchewan poultry industry;
- an analysis and review of many possible new manufacturing industries for a medium size Saskatchewan town;

  As a result, SRC produced a set of "profiles" for selected manufacturing opportunities and presented a seminar for community participants on "How To Start And Expand A Business".
- assistance to other communities by providing service to several organizations that work with handicapped people.

The Council will continue to expand its capabilities in market research, feasibility studies and general consulting.



ENGINEERING CONSULTING

SRC is concerned with a variety of projects for industrialization which included:

- a project for the design of Saskatchewan-manufactured steel buildings;
- studies concerning solar energy storage units for a crown corporation;
- a study evaluating the feasibility of establishing an air cushion vehicle industry in Saskatchewan;
- a study concerning the utilization of pressure cells in improving the design of potash mines;
- a project concerned with hydraulic mining and transportation of coal.

SRC is in the process of completing: consulting work involving the design, construction and commissioning of a creep test laboratory for the potash industry; as well as many projects in the ceramics lab, for such clients as the SDH&T, DNS, a concrete block manufacturer and a brick plant.

PUBLICATION

Eyre, D., *Saskatchewan Conservation House Design Working Group*. A non-technical summary of the design features and concepts of the Saskatchewan Conservation House. SRC Circular, November, 1977.

CONTRACT

A Study of the Feasibility of Establishing an Air Cushion Vehicle Industry in Saskatchewan: Transport Development Centre (Ministry of Transport) SDH&T. Transportation Agency of Saskatchewan, Sask. Dept. of Industry and Commerce.

Industrial Minerals

Saskatchewan has large reserves of raw materials in the industrial minerals category. With the exception of potash, such materials are produced by small companies which do not undertake research and development (R & D). Consequently, SRC has developed a long-term program to assist in the development of industrial minerals in Saskatchewan. Considerable expertise now exists in the Council for development and innovation in the industrial minerals field.

CONTRACTS

- Development for Solar Energy Storage, Saskatchewan Minerals.
- Raw Material for Whitewares, Saskatchewan Minerals.
- Investigation of a Light Aggregate, SDH&T.
- Development of a Silica Sand Deposit, DNS.
- Light Weight Aggregate Production, Apex Concrete.
- Research and Development Program, Estevan Brick.
- Raw Material Evaluation, Thunder Brick.
- Design, Construction and Commissioning of a Potash Creep Test Laboratory, DMR.
- Development of Pressure Cells for Potash Mines, EMR.

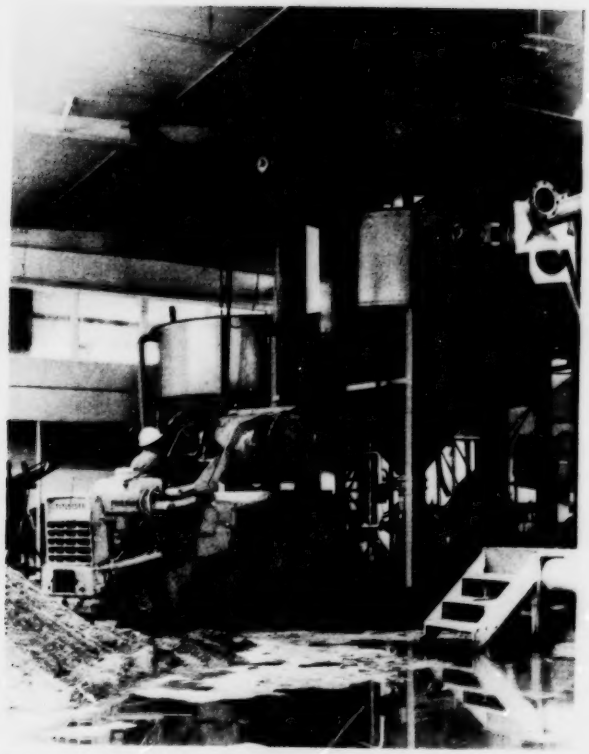
Transport of Solid Materials Through Pipelines

Solid raw materials are being transported long distances through pipelines in other parts of the world. The solid materials are mixed with water, pumped through the lines as a slurry and then separted from the water at the final destination. The potential is high for such a method of transportation in Canada. Most of the cost is for initial construction; therefore, once a pipeline is constructed, inflationary effects become minor. Environmental and social effects of such pipelines are negligible.

SRC has established a centre of excellence for the hydraulic transport of solid materials through pipelines. The centre is operated under contract with the Canadian Government and undertakes studies for private industry. Staff has earned international respect for this work.

CONTRACTS

- Pipeline Transport of Coarse Coal, Transport Development Centre (Ministry of Transport).
- Attrition of Coal during Hydraulic Mining, Denison Coal Limited.
- Hydraulic Transport of Tar Sand Tailings, Great Canadian Oil Sands Limited and Syncrude.



The SLURRY PIPELINE facility at SRC investigates the transportation of materials such as lignite or potash suspended in a liquid such as water. SRC has earned international respect for this work.

CHEMICAL PROCESS RESEARCH

Following the development of a method for producing high density pellets from Saskatchewan peat moss, work has continued on finding new uses for this material. Investigations have been conducted on the conversion of compressed peat moss to a high grade activated carbon. Such carbon would be ideal for the tertiary treatment of sewage and industrial effluents.

Studies have been completed on a new method to remove low concentrations of radium ions from mine or tailings-pond water. The process has been sent to several mine operators to be evaluated under field conditions.

SRC has gained much knowledge and skill by evaluating various leather-making processes. All of this information is available to prospective manufacturers.

FOSTERING THE TECHNICAL UPGRADING OF SASKATCHEWAN INDUSTRY

A number of projects are concerned with building up management R & D and the technical capabilities of Saskatchewan industry. One project involves assisting Saskatchewan industry in taking full advantage of Federal R & D grants. This project consists of advising companies on the great variety of programs available. In many cases, the involvement goes beyond the advice stage to include planning the project, as well as preparation and follow-up of the formal application. This service has been appreciated by smaller firms which do not have personnel free to do the necessary work.

During 1977, successful R & D applications brought over $110,000 into the Province to boost research and development. Several new projects are in the planning stage relating to the agricultural processing sector. This program has assisted several companies in being more competitive nationally and in the export market.

PUBLICATIONS FOR UPGRADING MANAGEMENT AND TECHNOLOGY

Most organizations have very small management libraries and subscribe to few management journals. To further assist upgrading of Saskatchewan industry, SRC publishes two periodicals: *Industrial Business Management* and *Techread*.

Industrial Business Management is designed to provide broad management know-how to both manufacturers and government. This periodical consists of reprints from the best articles of about 100 management publications plus frequent original contributions by the staff of SRC's Industrial Services Division.

Some of the titles during the past year were:

- Planning For the Future.
- Critical Factors in Establishing A Continuing Productivity Improvement Program in Government and Industry.
- The In-House Team Approach to Problem Solving and Consulting.
- Guidelines For A Productive Organization Structure.
- Who Needs A Management Consultant.
- Improving Your Productivity By Paying Your Workers More.

A new publication, *Techread*, has been launched to replace the old *Catalyst*. *Techread* is a new selective technology transfer system. The distribution of irrelevant information is avoided by selecting particular technological information specifically for certain industries. Items are sent to industries as often as useful articles are available. In addition, *Techread* is structured to foster requests for further information and assistance from SRC's Industrial Services Division.

PUBLICATIONS

Scharf, Alan, *The Role of the Board of Directors* (31 page booklet). March, 1977.

Scharf, Alan, *Fifteen Ways to Make More Money Now*. Business Review, Spring, 1977. Saskatchewan Chamber of Commerce.

Scharf, Alan, *A Marketing Strategy For The Economic Reality*. Business Review, Summer 1977. Saskatchewan Chamber of Commerce.

Scharf, Alan, *Business and Industrial Development For Your Community*. Business Review, Fall 1977. Saskatchewan Chamber of Commerce.

Scharf, Alan. *20 Rules For Practical Time Management*. (pocket card, revised).

Scharf, Alan. *Use Pareto's Law*. Insights and Innovations. September/October, 1977.

Scharf, Alan. *Ideals Concept: Problem Solving Opportunity Enhancement Guidebook*. 4th Edition. November, 1977.

GOVERNMENT PRODUCTIVITY

SRC has provided consulting assistance to government departments, the Saskatchewan Urban Municipalities Association, as well as various municipalities. These activities have included organization design, revenue sharing analyses and administrative management. SRC is interested particularly in working with smaller communities which face the threat of decline or economic difficulties.

INDUSTRIALIZATION

ENVIRONMENT

1– Design for Productivity
2– Peat
3– Uranium Tailings Pond
4– Leather
5– Solar Energy Storage
6– Whitewares
7– Silica Sand
8– Light Aggregate
9– Brick
10– Potash Creep Test
11– Pressure Cells for Potash Mines

INTRODUCTION

Man cannot survive without using the world's natural resources carefully. Every human activity affects the world around us to some degree and the full effect is difficult to evaluate because of the complex relations among living and non-living things. In construction or development proposals, the need for these developments and the relationship between their monetary costs and benefits are analyzed from both an engineering and economics standpoint. In addition to these customary economic analyses and discussions of need, recently society has recognized the necessity for a detailed assessment of the effect of a proposed development on the environment and thus, its ecological costs and benefits.

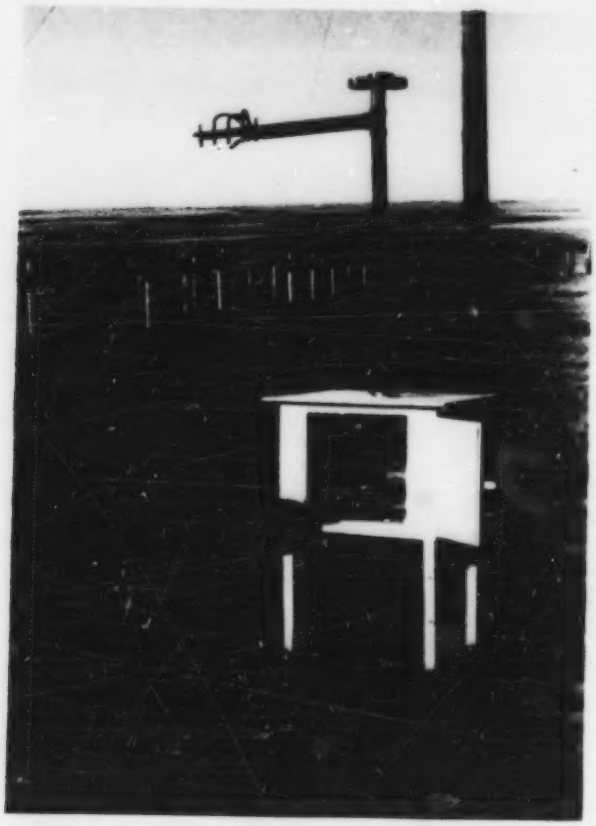
In proposed developments, NATURAL SETTINGS can be protected when an Environmental Impact Assessment is part of the decision process.

For any project which will have a significant effect on the natural and social environments, governments are adopting procedures to ensure that an environmental impact assessment is a part of a decision process. In Saskatchewan, intensive livestock operations, cereal grain farming, water resources development, recreational activities, thermal power plants, and mining operations are examples of projects with considerable interaction between man and his environment.

During the past five years, SRC has become increasingly involved in environmental studies in two areas: One, the provision of basic information which can be used broadly and two, the undertaking of environmental impact studies of specific projects on a contractual basis. In 1977, staff undertook ten projects of a general nature and fourteen contracts covering specific environmental impact assessments. By undertaking these contracts, the Council ensured that $370,000 worth of funds remained in Saskatchewan.

AIR

Weather Measurement and Modification



SAMPLE STATIONS are part of a project to study down-wind effects of weather modification within Saskatchewan.

Programs to modify the weather are being carried out in neighboring provinces and states. Chemicals, such as silver iodide, are introduced into clouds to increase precipitation. These chemicals eventually will end up in water supplies and the soil. SRC has undertaken a contract to study downwind effects of weather modification within Saskatchewan. Several stations have been designed and set up to sample air, water and biota for tracing chemical residuals from weather modification projects. Such chemical components, if they exist, could affect the cloud and precipitation patterns of the Province.

In an associated study, samples of ice crystals taken from clouds several seconds after they were seeded are being examined to detect trace levels of silver. The purpose of this study is to try to detect the presence of silver as the ice nucleant used to stimulate artificial precipitation.

Computer programs have been developed to estimate the local solar radiation available throughout the Province. Computerized mapping routines are being developed to display these data in conjunction with the related wind-power potential regime. These studies are relevant to environmental projects and energy resource development.

Pollution Monitoring

Industrialization and population growth tend to increase pollution of the atmosphere. Such pollution is minor in Saskatchewan at present. Care must be taken to ensure this pollution is kept under control. Studies have been initiated at SRC to assess the current background levels of sulphur in the atmosphere over the west-central regions of Saskatchewan.

Complex industrial centres are being planned for the northern part of Alberta. Atmospheric investigations in Saskatchewan are necessary since long range transport of sulphur is known to have particularly deleterious effects 40 to 400 kilometres downwind. A contract has been undertaken for Environment Canada to investigate acid precipitation levels originating from sulphur dioxide emissions from industrial operations. The area of study is north-western Saskatchewan which is downwind of the Athabasca tar sands development.

An empirical model has been set up to study the dispersion of elevator generated grain dust within a Prairie community. The model has been applied specifically to the community of Aberdeen, Saskatchewan, but results are general and can be applied to any Prairie community.

Another model was produced by modifying the atmospheric data of the first model in order to correlate worker health aspects with the level of contamination inside country elevators. The second model was found to be satisfactory to carry out a collaborative study of grain dust and health with the U of S's College of Medicine. Dynamic shape factors were investigated of grain dust

with irregular shapes within the respirable-size range. This shape factor computed from the geometry of dust particles has a significant effect on inhalation and deposition of dusts in the respiratory tracts of workers. A critical point is that the fibrous grain dust shape factor indicated a close agreement with the shape factor obtained from asbestos particles.

An International Symposium on Grain Dust and Health was held in Saskatoon during November 7th to 9th, 1977 and a paper was presented to describe the results of grain dust characterization by SRC.

PUBLICATION

Shewchuk, S. R., *Meteorological Influences on the Dispersion of Grain Dust in Communities on the Canadian Great Plains*, presented to the 11th annual Congress of the Canadian Meteorological Society, 1-3 June, 1977, Winnipeg, Canada.

WATER

Measurement of Precipitation

Extreme storms cause extensive damage to urban areas by flooding streets and inundating buildings. Information on the probability of such storms and their intensities (amount of precipitation per minute) for Saskatchewan is inadequate for urban engineering projects. Thus, seven hectares of the Idylwyld Freeway area in Saskatoon were instrumented just after construction to provide data on severe thunderstorms. The network of instruments provides data on runoff from paved and unpaved urban areas, flow patterns for various storm durations and storm intensities, as well as design criteria for sewers, pumping stations, open channel flow and storm water retention reservoirs. By using information from past storms, statistical methods can be devised to predict the probability of future storms of different intensities. Consequently, these data can show the economic risks of specific engineering designs for future drainage systems.

Location and Monitoring of Groundwater

Groundwater is a renewable resource which is widely used in Saskatchewan. The trial-and-error process of locating groundwater supplies frequently resulted in expensive well development because the exploration program lacked reliable geologic and hydrologic information. In recent years, the continual improvement of groundwater exploration has been due to the progressive accumulation of reliable information on the location, size, depth, and physical properties of aquifers and water quality. SRC's groundwater program data are available to the public, consultants, well drillers and government departments by direct contact and by published reports and maps. The Council received hundreds of requests during the year for information about the probable location and quality of groundwater supplies throughout the settled areas of the Province.

Groundwater can be managed as a resource if the appropriate information is available. The measurement of groundwater levels is an important management tool for estimating the availability of groundwater. SRC has a network of 50 wells which record the groundwater level at various locations in the settled area of the Province. These wells provide a continuous record of groundwater fluctuations. The program's objective is to more accurately predict the annual availability of groundwater by relating fluctuations in groundwater levels to climate.

CONTRACTS

- Hydrogeology of the Yorkton Area, Phase III, Saskatchewan Dept. of the Environment.
- Hydrogeology of the Regina Area, Saskatchewan Dept. of the Environment.
- Shaunavon Coal Utilization Project: Preliminary Hydrogeology, SPC.
- Hydrogeology of a Proposed Uranium Open Pit Mine in Northern Saskatchewan.
- Groundwater Monitoring, Potash Division Cominco.

PUBLICATIONS

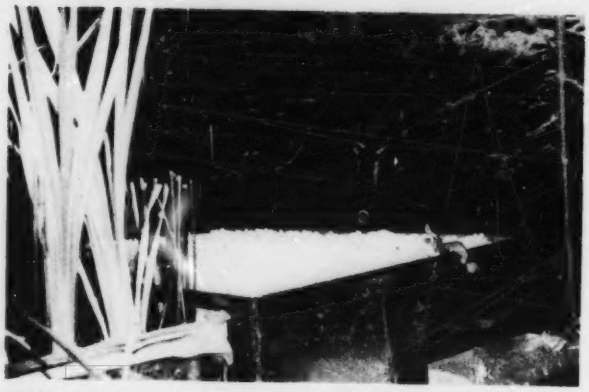
Maathuis, H., *Hydrogeology of the Yorkton Area, Phase III*, SRC Geology Report, May 1977 (Confidential).

Maathuis, H., *Shaunavon Coal Utilization Project — Preliminary Hydrogeology 1978*, SRC Geology Report (Confidential).

Puodzuinas, P. P., *Souris River Basin Study — Groundwater Study, Saskatchewan 1977* (Confidential).

Treatment and Monitoring of Water Pollution

The supplies of good water for domestic, municipal and industrial uses are limited in southern Saskatchewan. Therefore, pollution of these supplies by sewage, agricultural land runoff and industrial effluents must be minimized.



SRC's research has shown that BULRUSH and CATTAIL can remove phosphorus and nitrogen from sewage.

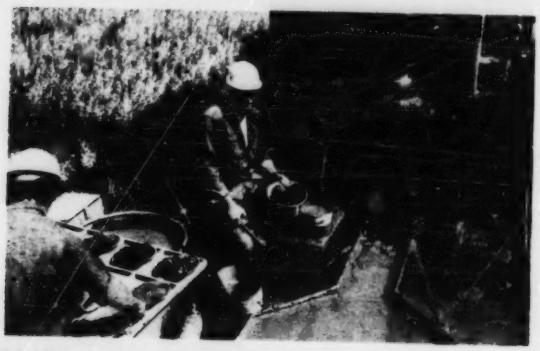
A simple, inexpensive and environmentally acceptable technique has been developed to provide tertiary treatments of municipal and agricultural effluents. SRC's experiments have shown that bulrush and cattail can be used effectively to remove phosphorus and nitrogen from

waste waters. Design data have been developed for large scale application of the technique. A proposal has been made to the Department of Municipal Affairs (DMA) for the application of the technique in rural areas in Saskatchewan. Experiments are being planned for using the technique to remove mercury and polychlorinated biphenyls (PCB's) from sediments in water.

The Federal Department of Environment awarded SRC a short research contract to study the phosphorus contribution from septic tank effluents in the Qu'Appelle Valley system. Numerous soil and water samples have been taken from lagoons, wells, tile fields and effluent disposal sites. An inventory has been completed of the cottages' effluent disposal practices and the tile fields in the area.

LAND

A POWER AUGER is used to obtain samples of sedimentary deposits within the upper 30 metres of the earth.



ROTARY drilling equipment is used in stratigraphic exploration to define the sequence of sedimentary deposits within the upper 300 metres of the earth.

In addition to the geological data gathered on the groundwater resources in the entire Province, basic geological information is being obtained on the glacial deposits in southern Saskatchewan. This information is of direct use in other activities including many contract projects.

The settled area of the Province is mantled extensively by sediments of various types deposited directly or indirectly by glacial processes. The physical properties and stratigraphy of the glacial sediments contribute important knowledge which assists:

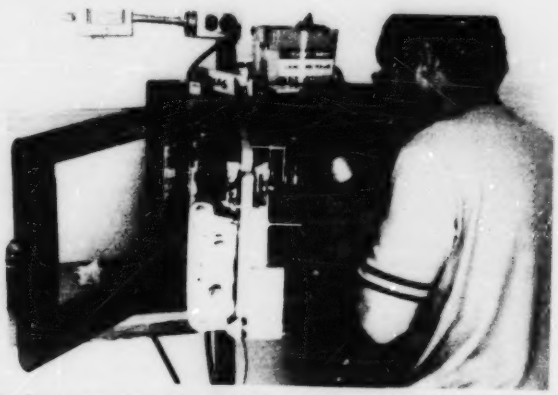
- In evaluating the agricultural resources of the soils developed on these sediments and the groundwater which occurs within their aquifers,
- In finding important deposits of sand, gravel and sub-grade materials for highways,
- In assessing pollution of the sediments by industrial and agricultural activities.

A program is underway to summarize and publish information collected over many years by SRC.

ENGINEERING ACTIVITIES

When designing, constructing and operating facilities for the general public, engineers have certain environmental conditions to consider. Either environmental effects upon the facilities have to be overcome or the effects of the facilities upon the environment have to be minimized. Solutions developed in other places are not applicable in many cases to the harsh climatic conditions of Saskatchewan. A number of studies have been carried out in 1977 by staff to obtain engineering data and methods related to environmental problems.

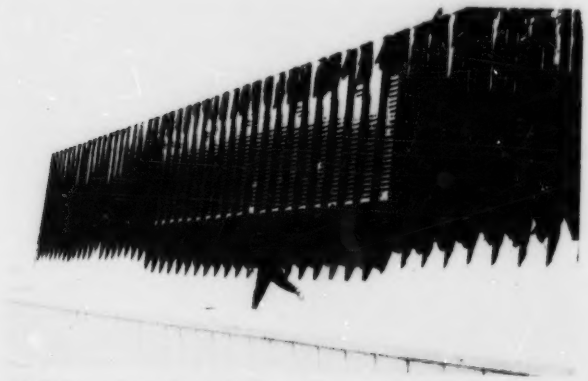
Investigation of Utilities and Structures



An instrument to MEASURE FROST PENETRATION was installed in Weyakwin by SRC. Such data will be used to specify designs of utilities for the best economic and technical performance in northern Saskatchewan.

A number of remote townsites in northern Saskatchewan are being provided with improved water and sewage utilities. Generally, these townsites lie close to the edge of the permafrost zone which presents the difficulty of deciding whether the utilities should be designed for permafrost or conventional conditions. This decision is economically important because of the high cost of construction and supply in the north. The Department of Northern Saskatchewan (DNS) is funding a four-year experimental program with SRC to investigate the behaviour of utilities at La Loche, Buffalo Narrows, Weyakwin and Cumberland House. The results will be

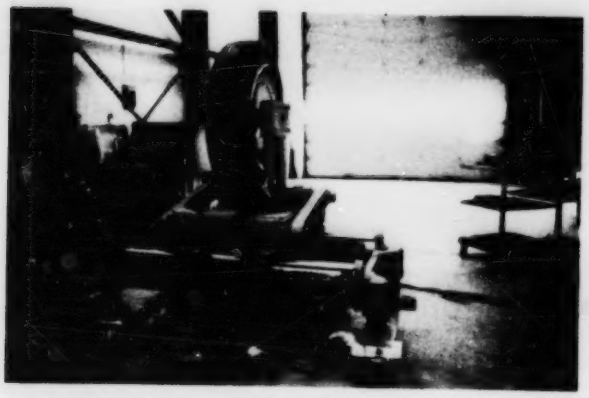
used to specify designs of utilities with the best economic and technical performance for northern Saskatchewan. This work is in its final year.



SNOW entering the FRESH AIR INTAKE on the U of S's Education Building during snowstorms is the subject of an SRC study to improve deflector design.

SRC staff is examining the amount of snow entering the fresh air intake on the Education Building at the U of S during snowstorms or periods of drifting snow. The purpose of this study is either to redesign the intake or to construct a series of deflectors which will reduce the amount of snow which enters fresh air intake.

Test Facilities and Display Model



A PAVEMENT TEST TRACK is being designed and built by SRC for SDH&T in Regina. This indoor facility is the first of its kind in Canada.

SRC is designing and building a pavement test track at Regina for the Department of Highways and Transportation (SDH&T). The Council is responsible for all aspects of the track, from building construction to the design and installation of special instruments to measure the pavement performance. The facility is an indoor test track which is the first of its kind in Canada. This indoor track will enable the SDH&T to evaluate new pavement designs under different climatic conditions within a matter of months instead of the years which are required when test sections are installed on public highways. As a result, new ideas and designs will be adopted more rapidly in the Provincial road network to improve the quality and reduce the cost of the roads.

Staff undertook a contract to test the scaling characteristics of the Poplar River Reservoir of the Saskatchewan Power Corporation (SPC). In the generation of electricity by burning coal, large quantities of cooling water are required to condense the steam which drives the electrical generating turbines. Cool reservoir water is pumped through metal tubes to condense steam on the outside of the tubes. The condensate is recycled to the boilers. Most reservoir waters tend to deposit scale inside the tubes, lowering the efficiency of the generating plant. To provide information on scaling prior to power plant operations, reservoir water was pumped continuously through a condenser tube test rig. This rig will indicate how much scaling will reduce efficiency.

A large, three-dimensional, TOPOGRAPHIC DISPLAY MODEL of the Qu'Appelle basin was completed under a contract with the Saskatchewan Department of Environment.

A topographic display model of the Qu'Appelle basin was completed under a contract with the Saskatchewan Department of Environment. The map was made in three dimensions as a large, room-sized display model. This involved the development of sophisticated injection-molding techniques for the plastic surfaces, together with special scribing devices used to put on the details. These processes are readily transferable to the plastic molding of a variety of display-model plans.

Impact Assessment Studies

Environmental impact studies are now a necessary part of major industrial and resource development activities in Canada. These studies attempt to measure the natural environment of a locality where a certain development is proposed, estimate the impact of this development, and suggest methods to reduce or eliminate undesirable effects of the proposed development.

Environmental Guidelines for Transportation Development

The Saskatchewan Department of Environment awarded SRC a contract to develop environmental guidelines for transportation development. The purpose of the study is to formulate a set of environmental guidelines for the planning, design, and construction of highways, roads, pipelines and electrical power transmission lines in Saskatchewan. Proponents of such projects must submit an environmental impact statement to the Department of the Environment. While the project is still in the planning stage, guidelines could expedite the procedure by making the developer or proponent aware of environmental concerns related to his project and by providing specific information on how to satisfy these concerns.

SRC staff is correlating the existing data on adverse environmental effects with relevant environmental protection measures in order to recommend guidelines in the light of what is feasible and practical in Saskatchewan.

An ARCHAEOLOGY FIELD CREW worked on an excavation in the Gronlid Ferry area.

Environmental Impact Studies Group

SRC has established a small group of Saskatchewan-based scientists with expertise in environmental impact studies. This group will form close contacts with research scientists at SRC and the University campuses in Saskatoon and Regina. The group is able to accommodate all aspects of environmental impact assessments, including air quality, terrestrial and aquatic biology, hydrology, and archaeology. Specialty services are subcontracted to Saskatchewan-based experts to ensure Provincial participation of the universities and the private sector in these studies.

This year, major activities concerned proposals for mining developments in the north and power developments in central and southern Saskatchewan. In addition, the group is involved in applied research studies in order to maintain expertise in various branches of science related to the environment. Projects currently in progress or completed during 1977 are:

- An environmental impact assessment of a hydroelectric development which includes studies of aquatic ecology, forestry, vegetation, recreation and transportation.
- A re-assessment of environmental conditions in a major reservoir several years after its formation.
- An environmental overview assessment of a proposed hydroelectric development in northern Saskatchewan.
- Environmental overviews of the reactivation of several uranium mines, as well as several proposed uranium mines.
- An environmental impact assessment in connection with a thermal power station.
- An environmental study related to alternate energy sources in southern Saskatchewan.

PUBLICATIONS

Meyer, David. *The Buffalo Narrows Archaeological Survey*. SRC Report C-77-9 (Confidential).

Meyer, David. *The Nipawin Archaeological Survey*. Report for the Sask. Power Corporation. SRC Report C 77-6 (Confidential).

Meyer, David. 1977. *Pre-Dorset, Settlements at the Seahouse Gully Site*. Archaeological Survey of Canada, Paper No. 57, Mercury Series, National Museums of Canada, Ottawa.

Meyer, D. and Light, James A., *The Charlot River Archaeological Survey*. SRC Report C 77-1 (Confidential).

Sawchyn, W. W., *Proposed Nipawin Hydroelectric Project — Aquatic Ecology*. SRC Report C 77-4 (Confidential).

Sawchyn, W. W., Kardash, E. W. and Cullimore, D. R., *A Limnological Survey of Boundary Reservoir*. SRC Report C 77-2 (Confidential).

Sawchyn, W. W. and Willard, J. R., *Environmental Overview Assessment for Dubyna 31-zone Bulk Sampling and Underground Exploration Program*. Report to Eldorado Nuclear Limited. SRC Report C 77-5 (Confidential).

Walker, Ernest G., *Archaeological Impact Assessment of the Coleville-Esther Pipeline Project*. SRC Report C 77-7 (Confidential).

Willard, J. R., *Environmental Overview for Cinch Lake Mining Development*. SRC Report C 77-3 (Confidential).

Willard, J. R. and Sawchyn, W. W., *Environmental Assessment of the Proposed Road from Cumberland House to Amisk Lake*. SRC Report C 76-5 (Confidential).

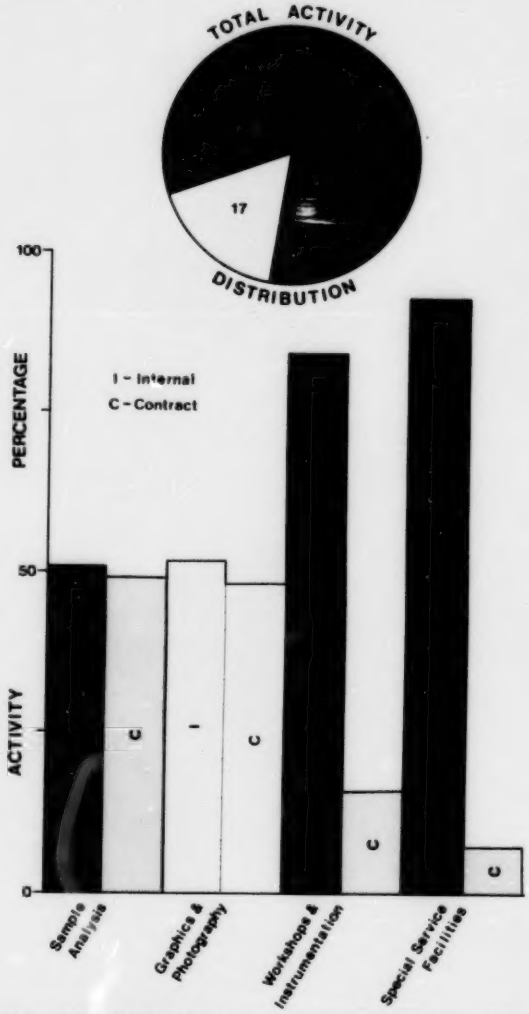
Willard, J. R. and Sawchyn, W. W., *Environmental Overview for the Charlot River Hydroelectric Development*. Phase I. SRC Report C77-1.

Willard, J. R., Sawchyn, W. W. and Light, J. A., *Environmental Overview for the Charlot River Hydroelectric Development*. Phase 2. SRC Report C 77-1 (Confidential).

Willard, J. R., Sawchyn, W. W. and Richert, D. J., *Forestry and Vegetation Study for the Proposed Nipawin Hydroelectric Project*. SRC Report C 77-8 (Confidential).

ENVIRONMENT

SERVICES



SPECIALIZED SERVICES were utilized both within SRC and for outside contracts.

Each of SRC's Divisions has organized specialized service projects and facilities designed to centralize expertise so that these services are available on a contractual basis, to all SRC staff and outside clients. These activities may be described under four headings: sample analysis, graphics and photography, workshops and instrumentation and special service facilities.

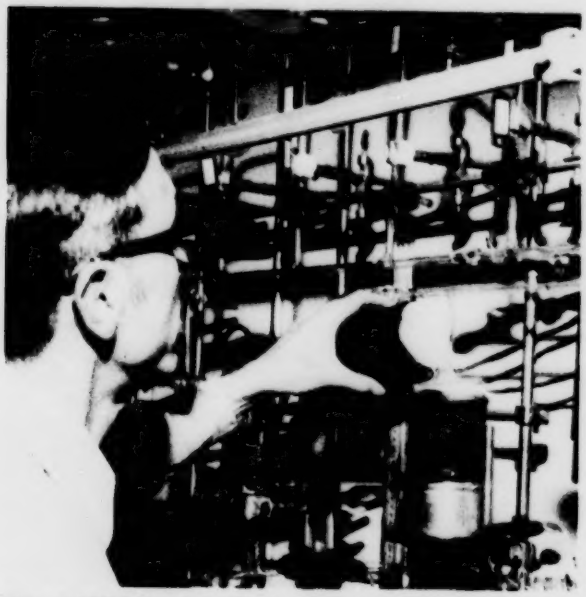
SAMPLE ANALYSIS

The CHEMISTRY LABORATORY serves as an analytical centre for a number of Saskatchewan industries.

Analytical services and applied research in chemistry lately has been a rapidly growing area. The laboratory serves as an analytical centre for gas-liquid chromatography of vegetable oil products and identification of components of new types of paint, for a number of Saskatchewan industries. In addition, low levels of radioactivity in the environment were measured both for monitoring present resource development activities and in assessing the environmental impact of future developments.

Billings to other SRC divisions and outside agencies has increased by 65 percent over last year. Such growth demands a progression of sophisticated instruments and automated equipment and an appreciable increase in staff and laboratory space.

Two new radiochemical counting systems are in service to increase data output. One automatic scintillation counting system, was designed by the Analytical Group and constructed by the instrument shops. This system, which was assembled for approximately 6,000 dollars, is equivalent to commercial systems which sell for 25,000 to 30,000 dollars. The second counting system was a used commercial automatic system purchased for a fraction of its replacement cost. These two systems provide a four-fold increase in the counting capacity of the radio chemical section.



The CARBON 14 DATING LABORATORY is the only facility of its kind in western Canada.

The Carbon 14 Dating Laboratory has worked another year to full capacity. Most of this work was contracted from the Museum of Man, the Geological Survey of Canada and the Department of Northern Saskatchewan (DNS). The rest of the work was done for Universities and archaeological societies from all parts of Canada.

The Geochemical Analysis Laboratory provides analytical services for Geology Division programs and undertakes custom analyses of geological samples for clients. The laboratory specializes in trace metal analysis of rocks, soils and lake sediments. This year, approximately 35,000 samples were analysed over a period of six months. To increase the efficiency of data processing and eliminate handling errors with this bulk of information, a Texas Instruments programmable terminal was attached to an atomic absorption unit to record on tape and print results directly. In addition, an automatic sampling device for the atomic absorption unit is being tested. These devices should increase the efficiency of analysing large numbers of samples.

GRAPHICS AND PHOTOGRAPHY

The Geology Division's Graphics Group is responsible for the design, preparation and production of publications, maps and displays for the Division and, when time permits, other SRC staff. This group maintains up-to-date inventories of topographic and base maps, aerial photographs, aerial photomosaics, E-logs, and general field-support data. Major projects undertaken were: preparation of the report and atlas of maps summarizing the geological investigation and inventory of lignite coal in the Province; the Ft. Qu'Appelle Geolog; as well as a Geology and Groundwater Resources map of the Cypress Hills area.

The expertise of the Graphics Group frequently is called upon to advise on intricate cartographic problems in government and in the private sector. Assistance has been provided on various mapping problems to the SDH&T, Department of Tourism and Renewable Resources, DNS, and DMR.

The GRAPHICS GROUP is responsible for the design, preparation and production of publications, maps and displays for the Geology Division. This group frequently is consulted by government and the private sector regarding cartographic problems.

The Instrumentation Graphics Group prepares the description and specifications of equipment designed and built by the Physics Division. This group services the continuing need for technical drawings, photographs and reports which adequately describe the equipment.

Documentation was completed for a user's manual for the Hoimeaga Recorder System together with a discussion of the principles of operation of the recorder. The system is a strip chart recorder specially designed and built to give the physical displacement of a liquid using a buoyant sensor system. This device is manufactured to order by the SRC.

A variety of drafting and photographic services provided line drawings and 35-mm color slides required for some projects at SRC.

The increased use of photography has enlarged extensively the use, by other divisions, of the photo lab and the darkroom facility.

The INSTRUMENTATION GRAPHICS GROUP produces descriptive users' manuals for equipment designed and built by the Physics Division.

PUBLICATIONS

Dyck, J. H., Reich, R. D., *Determination of Interelectrode Resistances of "Prototype Number 2" Electric Log Tool When Immersed in Water Under Pressure* SRC Report, P 77-4 (Confidential).

Perkins, E. H., Heinze, R. and Olm, O. J., *Hoimeaga Recorder System (model 03) User's and Service Manual.* SRC Report P 77-3.

WORKSHOPS AND INSTRUMENTATION

The engineering workshops continues to operate at capacity in the design, construction and initial operation of laboratory, pilot plant and field equipment for all divisions of SRC. The staff also operated the Council buildings, storage facilities and some field installations. A full preventative maintenance program was in effect for most SRC equipment currently in use. During 1977, an extra task involved assisting with the construction of the extension to SRC's Storage Building.

The precision instrument shop produces specialized scientific equipment whenever a particular device cannot

The PRECISION INSTRUMENT SHOP designs, builds and services many complex instruments required in SRC's research program.

be purchased for the required task, demanding for example ruggedness and reliability under outside weather conditions in Saskatchewan. Examples include: the mobile weather monitoring station used in the pesticide spray drift study was redesigned completely to improve versatility and response; specialized recorder units were built for the Chemistry Division; air pollution sampling devices were built for the Physics Division.

However, in response to purchase orders from outside clients, much of the shop's work involved production of a number of units of two specific instruments. These were the highly successful water level recorder, modified in some instances to operate as recording piezometers down very deep wells, and the rotary fusion burner for uranium ore sample preparation.

Some smaller instrument design jobs also were undertaken, which included: microscope projector units for the DNS; clock drives for the U of S; and recorder chart viewers for the Prairie Agricultural Machinery Institute.

In addition to providing specialized support for the

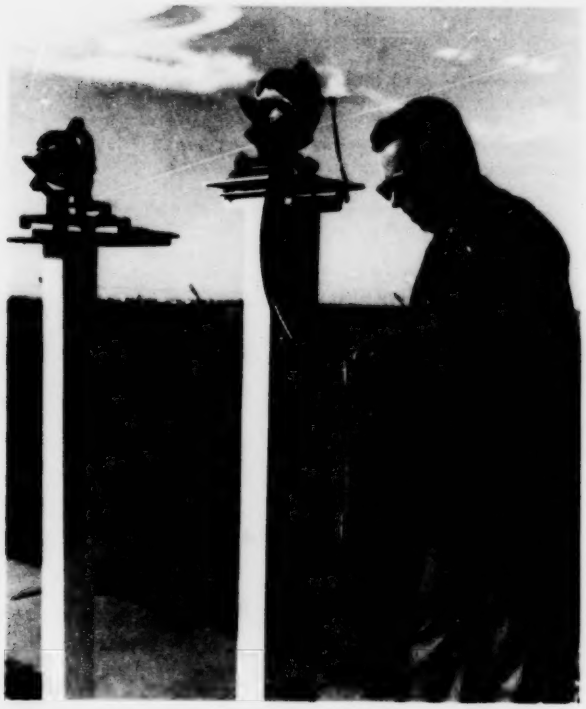
The ELECTRONICS LABORATORY provides contractual and in-house service including consultation, design, fabrication and maintenance of electronic instruments and systems.

SRC's research program, the electronics laboratory continued to provide extensive contractual service to an increasing number of outside agencies in government, university and industry. This service included consultation, design, fabrication and maintenance of electronic instruments and systems.

This year, the laboratory's major project was the design and development of a Microcomputer Assisted Digitizer used in the analysis of coal resources and groundwater data in the Province.

Preliminary work has been done on the design and development of a current peak-shaving controller under contract with the SPC. This device is intended to minimize peak demand on the electrical grid. Such a controller will optimize power plant capacity and reduce the need for additional power plants.

Related to the work of the electronics lab, SRC gave a grant-in-aid to the U of S's Dr. K. V. Paulson of the Physics Department and Dr. C. E. Hope of the Anaesthesia Department for the development of a compact microprocessor system to monitor a patient's condition in the operating room, or when under intensive care. A prototype was demonstrated this year and the device has the potential for local manufacture, as well as being a useful system for smaller hospitals.



DAILY WEATHER OBSERVATIONS are recorded at SRC's bench-mark climate station which is an integral part of the Atmospheric Environment Service's station operating program.

SPECIAL SERVICE FACILITIES

SRC continues to operate the baseline Climate Reference Station for the Province, mostly supported by a contract with the Atmospheric Environment Service. The provision of weather data and minor consultation services to the public forms an integral part of the station operating program. Adding a microprocessor system will provide for immediate processing of climatic data, as well as facilitate the inter-comparisons necessary in the maintenance of a "Bench-mark" station.

An SRC grant-in-aid went to Dr. B. W. Currie of the U of S's Physics Department to continue his work on the International Magnetospheric study which involves a search for solar-terrestrial weather and climate relationships for the prairies. Eventually, such observational data might be used for comparisons with climate fluctuations, such as drought.

LIBRARY FACILITIES at SRC serves as a tool for staff and industry.

The technical library supports all of SRC's industrialization and research activities. This library serves as a vital link between current projects and the world body of knowledge. Over 3,000 requests are processed annually for documents and answers to information sources. Our library consists of over 10,000 books, 400 journal subscriptions and numerous reports and pamphlets. Supplementing this service is our on-line information retrieval program which is used by both SRC's staff and outside clients. The retrieval program provides; market information to assist a local firm in evaluating a company acquisition, current information for government research grant applications, as well as, assistance in solving technical problems by various manufacturers.

PUBLICATIONS

Arnold, R. G., Smith, J. W. J., *Summary of Mercury Concentrations in Rocks, Overburden, Muskeg and Lake Sediments Collected by SRC in Precambrian Areas of Saskatchewan*. Geol. Div. Circular 11, 1977.

Coxworth, E., Kernan, J., Nicholson, H. and Chaplin, R. 1977. *Improving the Feeding Value of Straw for Ruminant Animals*. On Farm Waste Utilization for Feed-Opportunities and Profits for Livestock Producers, to be published by Agricultural Economics Research Council of Canada, Ottawa, Ontario.

Coxworth, E., and Thompson, D. *Searching for Appropriate Technologies to Resolve the Conflicts between Development and the Environment of the Canadian Plains*. To be published in the Proceedings of the Canadian Nature Federation Conference on Nature and Change on the Canadian Plains held in Regina, Sask., August, 1977.

Dyck, J. H., Reich, R. D., *Determination of Interelectrode Resistances of "Prototype Number 2" Electric Log Tool When Immersed in Water Under Pressure*. SRC Report, P 77-4 (Confidential).

Eyre, D., *Energy Conservation in Farm Homes*. Seminar on Energy Conservation in Agriculture, Regina and Saskatoon, April 15-16, 1977.

Eyre, D., *The Saskatchewan Conservation House — Its Impact on the Building Trades*. Annual conference of Saskatchewan Branches of HUDAC, Waskesiu, September 17, 1977.

Eyre, D., *The Design Concepts of the Saskatchewan Conservation House*. Meeting of the Saskatoon Branch, Solar Energy Society of Canada Inc., June 21, 1977.

Eyre, D., *Insulation — the Logical Way to Conserve Energy*. University of Regina, Department of Extension, Solar Heating Course, Fall 1977 Semester.

Eyre, D., *Saskatchewan Conservation House Design Working Group*. A non-technical summary of the design features and concepts of the Saskatchewan Conservation House. SRC Circular, November, 1977.

Eyre, D., Jennings, D., Thompson, D., Besant, R., Dumont, R., Grolle, H., *A collection of technical notes relating to the design of the Saskatchewan energy-conserving demonstration house*.

Fox, J. S., *Rapid Pyroclastic Mapping in Base Metal Exploration*. Can. Inst. Mining Jour., March, 1977.

Fox, J. S., *Preliminary Litho-Geochemistry Maps of the West Amisk Area: Lead, Zinc and Copper in Area 63L-9W 1/2-16 SW Portion*. SRC 1977.

Fox, J. S., *Geology of Saskatchewan Mining Development Corporation Grids in the May Lake Area, Sask. 1977 (Confidential)*.

Fox, J. S., *Reconnaissance Geology of Saskatchewan Mining Development Corporation Claim Blocks CBS 3102 and 3103, Missi Island Area, Saskatchewan. 1977 (Confidential)*.

Fox, J. S., *Silica Normalization of Drill-Hole Geochemical Data from the Volcanic Rocks of the Hanson Lake Mine, Saskatchewan*. SRC Geol. Circular 10, 1977.

Grover, R., Kerr, L., Wallace, K., Yoshida, K., and Maybank, J., *Residues of 2,4-D in Air Samples from Saskatchewan: 1966-1975*. Jr. Environ. Sci. Health, B 11(4): 331-346. 1976.

Hoeve, J., *Uranium Metallogenic Studies II. Rabbit Lake, Mineralogy and Geochemistry*. In Summary of Investigations, 1977. DRM, Regina, Sask.

Kernan, J., Coxworth, E., Nicholson, H. and Chaplin, R. 1977. *Ammoniation of Straw to Improve Its Nutritional Value as a Feed for Ruminant Animals*. Extension Publication No. 329, College of Agriculture, U of S.

Lehto, D. A. W., Arnold, R. G., Smith, J. W. J., *Lake Sediments as Media for Exploration in Saskatchewan*, Sask. Geol. Soc., Special Pub. No. 3, Editor, C. E. Dunn, 1976.

Lehto, D. A. W., Smith J. W. J., Arnold R. G., *Multimedia Geochemical Evaluation of Anomalous Metal Concentrations in Lake Sediments — Summary Report, 1977*. Published in Three Volumes, DMR OPEN FILE 1978.

Maathuis, H., *Hydrogeology of the Yorkton Area, Phase III*. SRC Geology Report, May 1977 (Confidential).

Maathuis, H., *Shaunavon Coal Utilization Project — Preliminary Hydrogeology 1978*. SRC Geology Report (Confidential).

Maybank, J., Yoshida, K., and Grover, R., *The Magnitude and Importance of Spray Drift from Agricultural Applications*. Air Pol. Control Assn. Paper 77-45.2, June, 1977.

Maybank, J., Yoshida, K., Shewchuk, S. R., and Grover, R., *Spray Drift and Swath Deposit Pattern from Agricultural Pesticide Application: Report of the 1976 Field Trial Program*. SRC Report P 77-1.

Meyer, David, *The Buffalo Narrows Archaeological Survey*. SRC Report C-77-9 (Confidential).

Meyer, David, *The Nipawin Archaeological Survey*. Report for the Sask. Power Corporation. SRC Report C 77-6 (Confidential).

Meyer, David, 1977, *Pre-Dorset, Settlements at the Seahouse Gully Site*. Archaeological Survey of Canada, Paper No. 57, Mercury Series, National Museums of Canada, Ottawa.

Meyer, D. and Light, James A., *The Charlot River Archaeological Survey*. SRC Report C 77-1 (Confidential).

Pilon, C. A., *Bibliography and Index of Coal in Saskatchewan and Adjoining Provinces and States*. SRC Geol. Report 18, 1977.

Puodzuinas, P. P., *Souris River Basin Study — Groundwater Study, Saskatchewan 1977* (Confidential).

Sawchyn, W. W., *Proposed Nipawin Hydroelectric Project — Aquatic Ecology*. SRC Report C 77-4 (Confidential).

Sawchyn, W. W., Kardash, E. W. and Cullimore, D. R., *A Limnological Survey of Boundary Reservoir*. SRC Report C 77-2 (Confidential).

Sawchyn, W. W. and Willard, J. R., *Environmental Overview Assessment for Dubyna 31-zone Bulk Sampling and Underground Exploration Program*. Report to Eldorado Nuclear Limited. SRC Report C 77-5 (Confidential).

Scharf, Alan, *Business and Industrial Development For Your Community*. Business Review, Fall 1977. Saskatchewan Chamber of Commerce.

Scharf, Alan, *20 Rules For Practical Time Management*, (pocket card, revised).

Scharf, Alan, *Use Pareto's Law*, Insights and Innovations, September/October, 1977.

Scharf, Alan, *Ideals Concept: Problem Solving Opportunity Enhancement Guidebook*, 4th Edition, November, 1977.

Scharf, Alan, *The Role of the Board of Directors*, (31 page booklet), March, 1977.

Scharf, Alan, *Fifteen Ways to Make More Money Now*, Business Review, Spring, 1977, Saskatchewan Chamber of Commerce.

Scharf, Alan, *A Marketing Strategy For The Economic Reality*, Business Review, Summer 1977, Saskatchewan Chamber of Commerce.

Schreiner, B. T., *Quaternary Geology North: Cree Lake (74G), Lloyd Lake (74F) and Mudjatik Area (74B, N 1/2), Saskatchewan*. In Summary of Field Investigations, 1977. DMR, Regina, Sask.

Shewchuk, S. R., *Meteorological Influences on the Dispersion of Grain Dust in Communities on the Canadian Great Plains*, presented to the 11th annual Congress of the Canadian Meteorological Society, 1-3 June, 1977, Winnipeg, Canada.

Sopuck, V. J., Lehto, D. A. W., Alley, D. W., *Uranium Dispersion Studies in the Maguire Lake Area, Saskatchewan*. In Summary of Field Investigations, 1977. DMR, Regina, Sask.

Sundstøl, F., Coxworth, E. and Mowat, D. N. 1977. *Improving the Nutritive Value of Straw and Other Low Quality Roughages by Treatment with Ammonia*. Accepted for publication in World Animal Review.

Walker, Ernest G., *Archaeological Impact Assessment of the Coleville-Esther Pipeline Project*. SRC Report C 77-7 (Confidential).

Wallace, K., and Yoshida, K., *Size Analysis of Suspended Dusts By Sierra Cascade Impactor and Computer Graphic Techniques*. SRC Report P 77-6.

Willard, J. R., 1976. *Dispersal of California Red Scale, Aonidiella aurantii (Maskell) (Homoptera: Diaspidiae) in Relation to Weather Variables*. J. Aust. Ent. Soc. 15—395-404.

Willard, J. R., *Environmental Overview for Cinch Lake Mining Development*. SRC Report C 77-3 (Confidential).

Willard, J. R. and Sawchyn, W. W., *Environmental Assessment of the Proposed Road from Cumberland House to Amisk Lake*. SRC Report C 76-5 (Confidential).

Willard, J. R. and Sawchyn, W. W., *Environmental Overview for the Charlot River Hydroelectric Development*. Phase 1. SRC Report C 77-1.

Willard, J. R., Sawchyn, W. W. and Light, J. A., *Environmental Overview for the Charlot River Hydroelectric Development*. Phase 2. SRC Report C 77-1 (Confidential).

Willard, J. R., Sawchyn, W. W. and Richert, D. J., *Forestry and Vegetation Study for the Proposed Nipawin Hydroelectric Project*. SRC Report C 77-8 (Confidential).

Yoshida, K., and Maybank, J., *Physical and Environmental Characteristics of Grain Dust*. International symposium on Grain Dust and Health. Workshop: Environment, 1977.

Yoshida, K., Shewchuk, S. R., and Maybank, J., *Dynamic Shape Factor Determinations of Grain Dust*. Paper presented at 10th Aerial Technology Conf. Los Alamos Scientific Lab. N.M. 1977.

Yoshida, K., Shewchuk, S. R., and Maybank, J., *On the Nature of Environmental Grain Dust Pollution on the Canadian Prairie*. Air Pol. Control Assn. Paper 77-3.6. 1977.

Yoshida, K., Shewchuk, S. R., and Maybank, J., *Design of Sampling and Analytical Techniques for Respirable Grain Dust for Correlation with a Clinical Study of Pulmonary Disease Characteristics Among Grain Handlers*. SRC Report P 77-2.

THE UNIVERSITY PROGRAM

SCHOLARSHIPS

The Government of the Province of Saskatchewan offers graduate research scholarships tenable at either the University of Saskatchewan or the University of Regina. The purposes of the awards are to assist graduate students to prepare for careers in scientific and industrial research and to create interest in the exploitation of Saskatchewan's resources and in techniques that will advance the development of the Province. SRC conducts the selection of the awards.

Awards valued at $5,000 for the year beginning October 1, 1977 were made to:

J. W. Rowson, Chemistry, University of Regina

Ms. A. E. McCann, Biology, University of Regina

Ms. B. Kirkpatrick, Animal Science, University of Saskatchewan.

GRANTS-IN-AID

Since its creation in 1947, the Saskatchewan Research Council has provided grants to University of Saskatchewan applicants for applied research in the sciences. Seventeen grants totalling approximately $87,000 were awarded in 1977 to applicants at both the University of Saskatchewan and the University of Regina.

The following projects presently are receiving support under the grants-in-aid program:

UNIVERSITY OF REGINA

DEPARTMENT OF ENGINEERING

Microwave Irradiation Enhancement of Grain Seed Germination and Plant Growth

under the direction of
Professor P. Bhartia.

DEPARTMENT OF PHYSICS

Photo-voltaic Photoelectric Assisted Electrolysis of Water

under the direction of
Professor J. F. Kos.

UNIVERSITY OF SASKATCHEWAN

DEPARTMENT OF ANATOMY

Cholesterol Binding by Alfalfa Fibre

under the direction of
Professor S. Fedoroff.

DEPARTMENT OF CIVIL ENGINEERING

Slope Stability in Cretaceous and Tertiary Bedrock Formations

under the direction of
Professor J. Krahn.

Design Considerations for Swelling Clays

under the direction of
Professor D. G. Fredlund.

Modelling of Snow Movement and Accumulation

under the direction of
Professor J. M. Wigham.

Measurement of Pollution from Agricultural Areas

under the direction of
Professor T. H. Lackie.

DEPARTMENT OF GEOLOGICAL SCIENCES

Geology of the Alwinsal No. 2 Potash Shaft

under the direction of
Professors
W. K. Braun,
W. G. E. Caldwell,
D. M. Kent, and
L. W. Vigrass.

Development of Seismic Reflection as a Tool for Subsurface Mapping and Mineral Prospecting in the Canadian Shield

under the direction of
Professors
M. Stauffer and
Z. Hajhal.

DEPARTMENT OF HOME ECONOMICS

Modification of Field Pea Flour and Protein Concentrate Properties

under the direction of
Professor A. K. Sumner.

DEPARTMENTS OF HORTICULTURAL SCIENCE AND MECHANCIAL ENGINEERING

Utilization of Stack Gases from a Coal-fired Boiler for Greenhouse Vegetable Production

under the direction of
Profressors
E. A. Maginnes and
G. H. Green.

DEPARTMENTS OF PHYSICS AND ANAESTHESIA

Micro Processor-based Patient-monitoring System

under the direction of
Professors
K. V. Paulson and
C. E. Hope.

DEPARTMENT OF SOIL SCIENCE

Nature and Physico-Chemical Properties of Selected River and Stream Sediments in the Upper Qu'Appelle River Basin in Saskatchewan

under the direction of
Professor P. M. Huang.

DEPARTMENT OF VETERINARY PATHOLOGY

Preliminary Investigation of the Prevalence and Epizootiology of Certain Infectious Diseases of Muskrats at Pike Lake, Sask.

under the direction of
Professor G. A. Wobeser.

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING

Production of Sugar and Protein from Aspen Chips and Fibre

under the direction of
Professor D. G. MacDonald.

INSTITUTE OF SPACE AND ATMOSPHERIC STUDIES

Support of the Coordinating IMS Secretariat and Programs Related Particularly to Saskatchewan

under the direction of
Professor B. W. Currie.

DEPARTMENTS OF VETERINARY PHYSIOLOGICAL SCIENCES, DAIRY AND FOOD SCIENCE, CHEMISTRY AND CHEMICAL ENGINEERING

Adaptation of Standard *in vitro* Forage Digestibility Procedure

under the direction of
Professors
R. K. Chaplin,
G. A. Jones,
J. F. Mathews, and
J. M. Pepper.

Copies of all papers published in the literature and of all theses resulting from grants-in-aid support by the Saskatchewan Research Council are available at the Saskatchewan Research Council library.

GRANTS-IN-AID

STAFF OF THE SASKATCHEWAN RESEARCH COUNCIL

ADMINISTRATION DIVISION

Pepper, T. P.	B.A., M.A., Ph.D., — Executive Director
Melvin, R. E.	B.E., P.Eng. — Administrative Officer
Hart, J. F.	A.A.S., B.F.A., M.A. — Communications Officer
Allen, C. C.	
*Davis, Y.	
Fidgett, R. B.	
Jones, L. R.	
*Larson, M.	
MacEwan, H. A.	
Makohoniuk, M.	
Ottmann, A. D.	
Rielkoff, W. M.	
Weegar, E. L.	

CHEMISTRY DIVISION

Coxworth, E. A.	B.A., M.A., Ph.D. — Head
Carter, J.	B.A.
Darrach, W. A.	
Fahri, M.	Chem. Tech.
Hill, J. L.	Chem. Tech.
Kardash, E. W.	B.Sc.
Kernan, J. A.	B.Sc., M.Sc.
Klassen, B.A.	Chem. Tech.
Kullman, P. W.	
MacDonald, L. A.	
Meyer, D.	B.A., M.A.
Nelson, B.	B.A., M.Sc.
Petrow, M.	
Pilon, C. A.	B.A., M.A.
Punani, S.	
Richert, D.	R.R. Tech.
Rutherford, A. A.	B.E., M.Sc.
Sawchyn, W. W.	B.A., M.A., Ph.D.
Smithson, G. L.	B.Sc., M.Sc., Ph.D., P.Eng.
Stolarchuk, D. E.	R.R. Tech.
Thompson, D. E. F.	B.Sc., M.Sc.
Ty, L.	Chem. Tech.
**Willard, J. R.	B.Sc., M.A., Ph.D.
Wittenberg, J.	
Woytowich, G. M.	
Wright, R. A.	

ENGINEERING DIVISION

Husband, W. H. W.	B.A.Sc., M.B.A., M.Sc., Ph.D., P.Eng. — Head
Bindle, K. R.	
Bouvier, R. E.	
Didur, D. B.	W.Sc. Tech.
Eyre, D.	B.Sc.
Filson, D. H.	B.E., M.Sc., P.Eng.
Freund, G. H.	B.Ed., B.A.
Gillies, R. G.	B.E., M.Sc.
Haas, D. B.	B.E., M.Sc., P.Eng.
Hesterman, L. C.	Aero. Tech.
Hudson, J. H.	B.A., M.A.
Jennings, D. R. G.	
Jones, J. T.	B.A.
Lakshman, G.	B.Sc., M.Sc.
Lindberg, E.	Mech. Tech.
MacPherson, R. J.	
McEwan, D. J.	
McKnight, R. K.	
*Martinsen, H.	
Meginbir, G. A.	B.A.
Mitchell, R. W.	Eng. Tech.
Nicolichuk, N. A.	Civil Tech.
Owens, K. A.	
Pope, B. C.	
*Reid, D.	
Small, M. H.	Lab. Tech.
Smith, B. J.	
Spyker, J. W.	B.E., M.Sc., P.Eng.
Storer, D. K.	B.Sc., Ph.D., P.Eng.
Whiting, J. M.	B.Sc., M.Sc.
Wright, J.	

GEOLOGY DIVISION

Arnold, R. G.	B.Sc., M.Sc., Ph.D. — Head
Alley, D. W.	B.Sc., M.Sc.
Bilewski, Z.	
*Christiansen, E. A.	B.S.A., M.Sc., Ph.D.
Emmons, V. F.	
Fox, J. S.	B.Sc., M.Sc., Ph.D.
Friesen, P. G.	
Hiebert, R. J.	
Hoeve, J.	B.Sc., M.Sc., D.Sc.
Holsten, A. D.	B.Sc.
*Honch, R.	B.E.
Jaworski, E. J.	R.R. Tech.
Kvinlaug, M. N.	
Lehto, D.	B.Sc.
Lemke, T. A.	
McIntosh, B.	
Maathuis, H.	B.Sc., M.Sc.
*Meneley, W. A.	B.Sc., M.Sc., Ph.D., P.Eng.
O'Brien, P. J.	B.Sc.
*Puodzuinas, P. P.	B.Sc.
Ross, W. C.	B.Sc.
Sardinha, C.	C.C.
Schreiner, B. T.	B.Sc.
Smith, J. W. J.	B.Sc.
Taylor, W. E.	C.C.
Turple, L.	B.Sc.
Walton, B. C.	
*Whitaker, S. H.	B.A., Ph.D.
*Winiski, K.	B.A.
Woodhouse, W. P.	

INDUSTRIAL SERVICES DIVISION

Scharf, A.	B.Sc., P.Eng., SMAIIE — Head
*Adeland, R.	B.A., M.B.A.
Armstrong, L. M.	
Chan, R.	B.A. Sc.
*Douglas, C. A.	B.Sc., P.Eng.
Glossop, D.	L.M.I.
*Humeny, M. J.	Lib. Tech.
Kuchinka, C. L.	B.E., P.Eng.
Levesque, D. B.	
Levesque, R.	B.E., P.Eng.
Macdonell, F. J.	Lib. Tech.
McPherson, K.	B. Sc., AMRAeS
Pierce, G. L.	B.Sc., M.Sc., P.Eng.
Walkow, D.	
Zuk, B.	B.E., B.A., P.Eng.

PHYSICS DIVISION

Maybank, J.	B.Sc., M.Sc., Ph.D. — Head
Barnett, D. B.	NBTI
Bergsteinsson, J. L.	B.Sc., B.Ed.
*Brander, K. L.	B.A.
Calvert, J. G.	
Dyck, J. H.	B.Sc., Ph.D.
Heinze, R.	
Klatt, B.	
McKenzie, C. T.	B.Sc.
Matieshin, F. T.	
Olm, O. J.	
Ostwald, W.	
Perkins, E. H.	Civil Tech.
Pershyn, C. S.	
Peters, M. L.	
Reich, R. D.	Arch. Tech.
Ross, W. H.	B.Sc.
Shewchuk, S. R.	B.Sc., M.Sc., Ph.D.
*Sloman, I. S.	B.Sc.
Wallace, K. W.	B.Sc.
Yoshida, K.	B.Sc., Ph.D.

*Terminated Employment
**Deceased

THE SASKATCHEWAN RESEARCH COUNCIL

FINANCIAL STATEMENT

Year Ended March 31, 1977

AUDITOR'S REPORT

To the Members of the Legislative Assembly
of the Province of Saskatchewan:

I have examined the balance sheet of the Saskatchewan Research Council fund as at March 31, 1977 and the statement of operations and operating surplus for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion these financial statements present fairly the financial position of the Fund as at March 31, 1977 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Regina, Saskatchewan,
June 24, 1977

W. G. LUTZ, C.A.
Provincial Auditor.

SASKATCHEWAN RESEARCH COUNCIL FUND

NOTES TO FINANCIAL STATEMENTS

March 31, 1977

1. Accounting Policies

(a) Fixed Assets

(i) The Saskatchewan Research Council utilizes fund accounting wherein all receipts and expenditures including those for fixed assets appear in the statement of revenue and expenditures. To maintain accountability for fixed assets, it is necessary to record them as a balance sheet asset with a corresponding entry to "Equity in Fixed Assets". Because asset purchases and sales appear in the statement of revenue and expenditure, no provision has been made for depreciation on fixed assets.

(ii) The Council's policy is to remove the cost of all equipment from the accounts which have:

- become obsolete during the year
- been sold during the year
- been in service for ten years.

(b) Principles of Consolidation

The Council's subsidiary does not follow fund accounting practices adhered to by the Council. As a result of the incompatibility of accounting practices, the accounts of the subsidiary are not consolidated with those of the Council but are accounted for by the equity method.

2. Shareable Costs Recoverable

Under the terms of a four year agreement with the Federal Government Agency administering the Agricultural Rehabilitation Development Act, the Council has incurred expenditures of $266,496 on the Brackish Water Purification project during the period April 1, 1974 to March 31, 1977. The agreement allows the Council to recover from the Federal Government Agency, one-half of all eligible expenditures.

As at March 31, 1977 the Council had received all but $24,070 of the total $133,248 recoverable.

3. Employees' Pension Fund

The actuary of the Employees' Pension Fund, stated in his report dated July 1975, that as at May 1, 1974 there was a deficiency in the Fund, in respect to past service benefits, of $88,613. In order to liquidate this deficiency the Saskatchewan Research Council must and is making fifteen annual instalments of at least $8,861 into the Fund.

The report also indicates that the Council's contributions for the cost of benefits in future years be at the rate of 139.81% of required employees' contributions.

4. Loan Payable — Province of Saskatchewan

During the year, a loan in the amount of $200,000 was received from the Government of Saskatchewan, such loan being interest bearing and repayable upon demand of the Minister of Finance.

5. Investment in Subsidiary

During the year a subsidiary of the Council was incorporated under The Companies Act of Saskatchewan. The company has been inactive from its incorporation on December 3, 1976 until March 31, 1977.

M121

IMPORTANT NOTE CONCERNING THE FOLLOWING PAGES

THE PAGES WHICH FOLLOW HAVE BEEN FILMED TWICE IN ORDER TO OBTAIN THE BEST REPRODUCTIVE QUALITY

USERS SHOULD CONSULT ALL THE PAGES REPRODUCED ON THE FICHE IN ORDER TO OBTAIN A COMPLETE READING OF THE TEXT.

REMARQUE IMPORTANTE CONCERNANT LES PAGES QUI SUIVENT

LES PAGES SUIVANTES ONT ÉTÉ REPRODUITES EN DOUBLE AFIN D'AMÉLIORER LA QUALITÉ DE REPRODUCTION

LES UTILISATEURS DOIVENT CONSULTER TOUTES LES PAGES REPRODUITES SUR LA FICHE AFIN D'OBTENIR LA LECTURE DU TEXTE INTÉGRAL

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca

Statement 1

SASKATCHEWAN RESEARCH COUNCIL FUND

BALANCE SHEET

March 31, 1977
(with comparative figures at March 31, 1976)

ASSETS

	1977	1976
Current:		
Cash in bank	$ 55,596	$ 57,458
Guaranteed savings deposit	642,835	225,579
Investments at cost which approximates market value	60,000	20,000
Accounts receivable	383,062	421,592
Shareable costs recoverable (Note 2)	24,070	35,100
Prepaid expenses	16,221	32,338
Total current assets	1,181,784	792,067
Investments, at cost which approximates market value	—	40,000
Deferred finance charges	9,331	—
Investment in and advance to subsidiary (Note 5)	2,055	—
Equity in Saskatoon Co-operative Association	202	202
	2,257	202
Fixed: at cost		
Laboratory equipment	816,470	733,122
Automotive equipment	164,919	177,707
Building	145,257	81,000
Furniture and fixtures	139,532	122,285
Shop equipment	60,286	58,766
Land	10,000	10,000
	1,336,464	1,182,880
	$2,529,836	$2,015,149

LIABILITIES

	1977	1976
Current:		
Accounts payable	$ 245,943	$ 249,581
Employee deductions payable	102,200	97,102
Deferred income	—	50,000
Loan payable — Minister of Finance (Note 4)	200,000	—
Principal portion of Agreement payable	3,808	—
Total current liabilities	551,951	396,683
Agreement payable: repayable in monthly instalments of $608 including interest	34,668	—
Less portion shown as current liability	3,808	—
	30,860	—

EQUITY

Equity in fixed assets (Schedule 2)	1,336,464	1,182,880
Operating surplus (Statement 2)	610,561	435,586
	1,947,025	1,618,466
	$2,529,836	$2,015,149

(See accompanying notes to the financial statements)

SASKATCHEWAN RESEARCH COUNCIL FUND

STATEMENT OF OPERATIONS AND OPERATING SURPLUS

Year Ended March 31, 1977
(with comparative figures for the 1976 year)

	1977	1976
Revenue:		
Province of Saskatchewan — grants	$2,281,400	$2,100,000
Other grants, contracts and fees from industry	1,889,430	1,475,550
	4,170,830	3,575,550
Expenditures (Schedule 1)	3,970,964	3,325,424
Excess of revenue over expenditure before the following:	199,866	250,126
Other income	33,413	25,996
	233,279	276,122
Research grants	58,304	88,275
Surplus for the year	174,975	187,847
Operating surplus, beginning of year	435,586	247,739
Operating surplus, end of year	$ 610,561	$ 435,586

(See accompanying notes to the financial statements)

Statement 1

SASKATCHEWAN RESEARCH COUNCIL FUND

BALANCE SHEET

March 31, 1977
(with comparative figures at March 31, 1976)

ASSETS

	1977	1976
Current		
Cash in bank	$ 55,596	$ 57,458
Guaranteed savings deposit	642,835	225,579
Investments at cost which approximates market value	60,000	20,000
Accounts receivable	383,062	421,592
Shareable costs recoverable (Note 2)	24,070	35,100
Prepaid expenses	16,221	32,338
Total current assets	1,181,784	792,067
Investments, at cost which approximates market value	—	40,000
Deferred finance charges	9,331	—
Investment in and advance to subsidiary (Note 5)	2,055	—
Equity in Saskatoon Co-operative Association	202	202
	2,257	202
Fixed, at cost		
Laboratory equipment	816,470	733,122
Automotive equipment	164,919	177,707
Building	145,257	81,000
Furniture and fixtures	139,532	122,285
Shop equipment	60,286	58,766
Land	10,000	10,000
	1,336,464	1,182,880
	$2,529,836	$2,015,149

LIABILITIES

	1977	1976
Current:		
Accounts payable	$ 245,943	$ 249,581
Employee deductions payable	102,200	97,102
Deferred income	—	50,000
Loan payable — Minister of Finance (Note 4)	200,000	—
Principal portion of Agreement payable	3,808	—
Total current liabilities	551,951	396,683
Agreement payable: repayable in monthly instalments of $608 including interest	34,668	—
Less portion shown as current liability	3,808	—
	30,860	—

EQUITY

Equity in fixed assets (Schedule 2)	1,336,464	1,182,880
Operating surplus (Statement 2)	610,561	435,586
	1,947,025	1,618,466
	$2,529,836	$2,015,149

(See accompanying notes to the financial statements)

Statement 2

SASKATCHEWAN RESEARCH COUNCIL FUND

STATEMENT OF OPERATIONS AND OPERATING SURPLUS

Year Ended March 31, 1977
(with comparative figures for the 1976 year)

	1977	1976
Revenue:		
Province of Saskatchewan — grants	$2,281,400	$2,100,000
Other grants, contracts and fees from industry	1,889,430	1,475,550
	4,170,830	3,575,550
Expenditures (Schedule 1)	3,970,964	3,325,424
Excess of revenue over expenditure before the following:	199,866	250,126
Other income	33,413	25,996
	233,279	276,122
Research grants	58,304	88,275
Surplus for the year	174,975	187,847
Operating surplus, beginning of year	435,586	247,739
Operating surplus, end of year	$ 610,561	$ 435,586

(See accompanying notes to the financial statements)

Schedule 1

SASKATCHEWAN RESEARCH COUNCIL FUND

SCHEDULE OF EXPENDITURES

Year Ended March 31, 1977
(with comparative figures for the 1976 year)

	Admin.	Chem.	Eng.	Geol.	Ind.	Phys.	Man. Consult.	1977 Total	1976 Total
Employee benefits	$ 17.569	$ 23.908	$ 43.947	$ 32.318	$ 13.707	$ 33.963	$ 4.212	$ 169.624	$ 147.222
Equipment purchases	77.609	88.581	18.177	35.744	2.253	24.794	178	247.336	188.235
Other	86.098	25.044	48.227	42.049	18.850	19.455	5.671	245.394	240.103
Salaries	183.096	365.725	574.559	482.723	195.038	368.798	57.119	2.227.058	1.910.878
Supplies	22.763	25.490	116.932	53.802	31.981	30.971	1.440	283.379	205.818
Technical services	50.826	(16.230)	256.744	288.412	14.741	39.358	273	634.124	447.829
Travel and vehicle operations	13.360	14.610	39.209	50.736	19.853	15.203	11.078	164.049	185.339
	$451.321	$527.128	$1.097.795	$985.784	$296.423	$532.542	$79.971	$3.970.964	$3.325.424

(See accompanying notes to the financial statements)

Schedule 2

SASKATCHEWAN RESEARCH COUNCIL FUND

SCHEDULE OF EQUITY IN FIXED ASSETS

Year Ended March 31, 1977
(with comparative figures for the 1976 year)

	1977	1976
Equity in fixed assets, beginning of year	$1,182,880	$1,029,657
Add:		
Fixed asset additions (Schedule 1)	247,336	188,235
	1,430,216	1,217,892
Deduct:		
Fixed asset disposals		
— written off (Note 1)	84,142	22,200
— sold	9,610	12,812
Equity in fixed assets, end of year	$1,336,464	$1,182,880

(See accompanying notes to the financial statements)

Schedule 1

SASKATCHEWAN RESEARCH COUNCIL FUND

SCHEDULE OF EXPENDITURES

Year Ended March 31, 1977
(with comparative figures for the 1976 year)

	Admin.	Chem.	Eng.	Geol.	Ind.	Phys.	Man. Consult.	1977 Total	1976 Total
Employee benefits	$ 17.569	$ 23.908	$ 43.947	$ 32.318	$ 13.707	$ 33.963	$ 4.212	$ 169.624	$ 147.222
Equipment purchases	77.609	88.581	18.177	35.744	2.253	24.794	178	247.336	188.235
Other	86.098	25.044	48.227	42.049	18.850	19.455	5.671	245.394	240.103
Salaries	183.096	365.725	574.559	482.723	195.038	368.798	57.119	2.227.058	1.910.878
Supplies	22.763	25.490	116.932	53.802	31.981	30.971	1.440	283.379	205.818
Technical services	50.826	(16.230)	256.744	288.412	14.741	39.358	273	634.124	447.829
Travel and vehicle operations	13.360	14.610	39.209	50.736	19.853	15.203	11.078	164.049	185.339
	$451.321	$527.128	$1.097.795	$985.784	$296.423	$532.542	$79.971	$3.970.964	$3.325.424

(See accompanying notes to the financial statements)

Schedule 2

SASKATCHEWAN RESEARCH COUNCIL FUND

SCHEDULE OF EQUITY IN FIXED ASSETS

Year Ended March 31, 1977
(with comparative figures for the 1976 year)

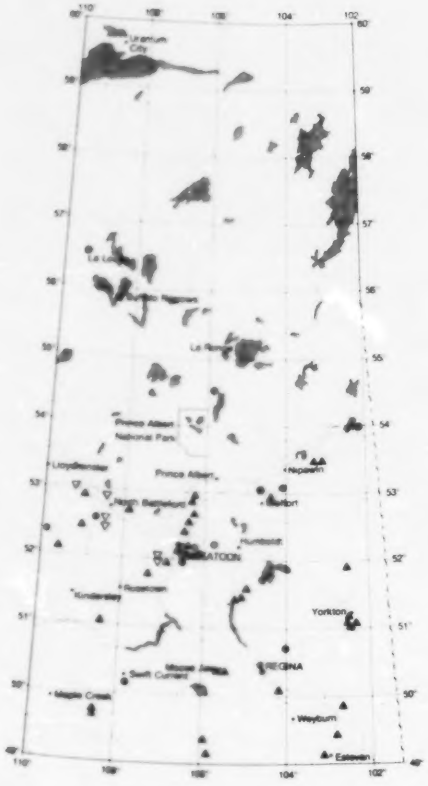
	1977	1976
Equity in fixed assets, beginning of year	$1,182,880	$1,029,657
Add:		
Fixed asset additions (Schedule 1)	247,336	188,235
	1,430,216	1,217,892
Deduct:		
Fixed asset disposals		
— written off (Note 1)	84,142	22,200
— sold	9,610	12,812
Equity in fixed assets, end of year	$1,336,464	$1,182,880

(See accompanying notes to the financial statements)

LIST OF ABBREVIATIONS

CISTI — Canadian Institute of Scientific and Technical Information.
DMA — Saskatchewan Department of Municipal Affairs.
DMR — Saskatchewan Department of Mineral Resources.
DNS — Department of Northern Saskatchewan.
DREE — Department of Regional and Economic Expansion.
EMR — Canada Department of Energy, Mines and Resources.
IMS — International Magnetospheric Study.
NRC — National Research Council.
PFRA — Prairie Farm Rehabilitation Act.
R&D — Research and Development.
SDA — Saskatchewan Department of Agriculture.
SDH&T — Saskatchewan Department of Highways and Transportation.
SPC — Saskatchewan Power Corporation.
SRC — Saskatchewan Research Council.
U of S — University of Saskatchewan.

LOCATION OF SASKATCHEWAN RESEARCH COUNCIL FACILITIES



EXPLANATION

- ▲ Observation well
- • Sewer and water study
- • Pesticide sampling site
- ○ Spray freezing site
- • Slough study
- + Ice crossing study
- ▽ Watershed
- • Mineral recovery freeze desalination site